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Flotation of Silver-Lead Mineral at a New South Wales Mine

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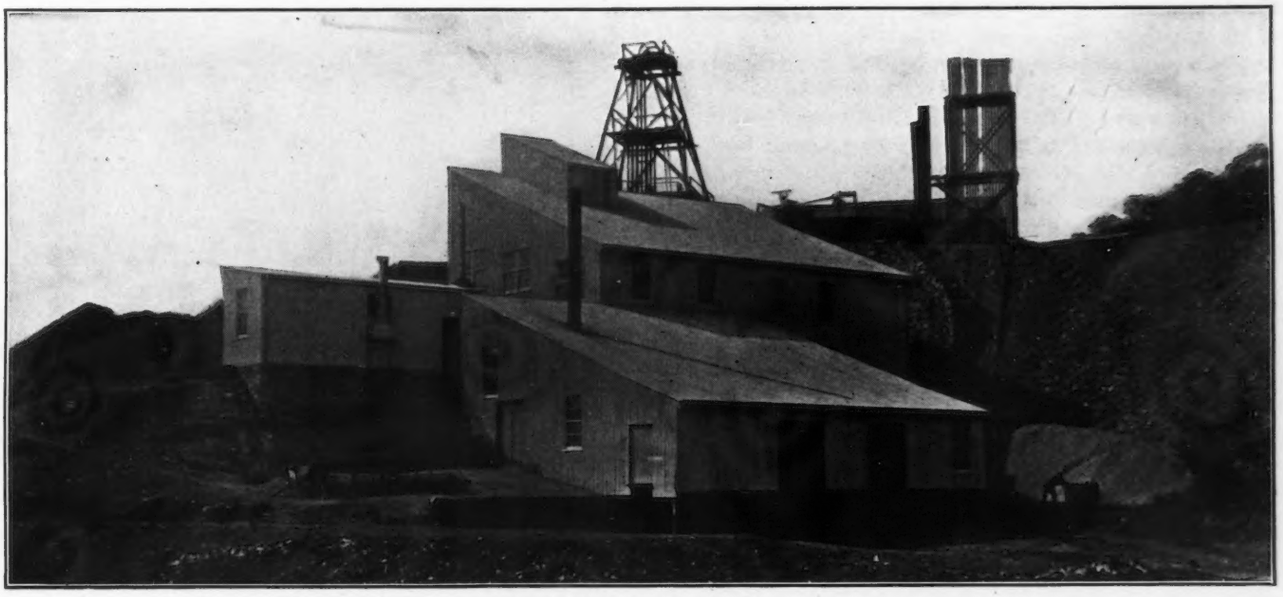
SYNOPSIS—A plant designed to treat a complex silver-lead ore where table concentration would not work. Many difficulties were met and surmounted, among which were a contaminated water-supply and much scale formed in the flotation machine. An original method of froth removal was devised. Details of practice fully discussed.

The small mill described in this article was erected at the Silver Peak mine for the purpose of treating the second-grade ores of the Yerranderie silver-lead mining field, New South Wales, Australia. Owing to the distance of the field from smelting works and the high cost of transport, over bad roads by horse teams, only the richest ores could be shipped at a profit. The question of smelting locally was studied, but owing to the highly siliceous nature of the "seconds" (about 70% SiO_2) and the difficulty of procuring suitable fluxes, the idea was abandoned.

The question of concentration was then considered, the problem proving to be a difficult one. The metallic minerals in the ore were, in order of importance: Galena, pyrite, marcasite, arsenical pyrite, blende, chalcopyrite and small quantities of secondary minerals from all the foregoing.

All these minerals carried silver to a greater or lesser extent, but the chief silver-bearing constitutents were the galena, and the iron sulphides, especially the marcasite. The galena occurred in two crystalline forms, one coarse and the other fine, the latter having a fracture similar to hard cast iron. This was rich in silver. Being extremely soft and friable, it slimed badly on crushing. Some of the ore contained it in such a fine state of dissemination that it appeared as a dark streak through the quartz, necessitating very fine grinding to free the values.



GENERAL VIEW OF THE SILVER PEAK FLOTATION MILL, VICTORIA, AUSTRALIA

The gangue was chiefly a hard glassy quartz with small quantities of felsitic country rock. From this description of the ore it will be readily understood that concentrating it was not simple.

Experiments were first made with gravity concentration, but the recoveries, especially of the silver, were low. The coarsely crystalline galena presented no difficulties, being amenable to jigging and table concentration; but this type was relatively low in silver, and the fine-grained variety, carrying the greater part of the silver, slimed so badly that no system of gravity concentration could give satisfactory recoveries. Flotation concentration was therefore tried, and as good results were reported from

*Suan mine, Holkol, Chosen.

small-scale tests made by Minerals Separation, a plant incorporating that process was decided upon.

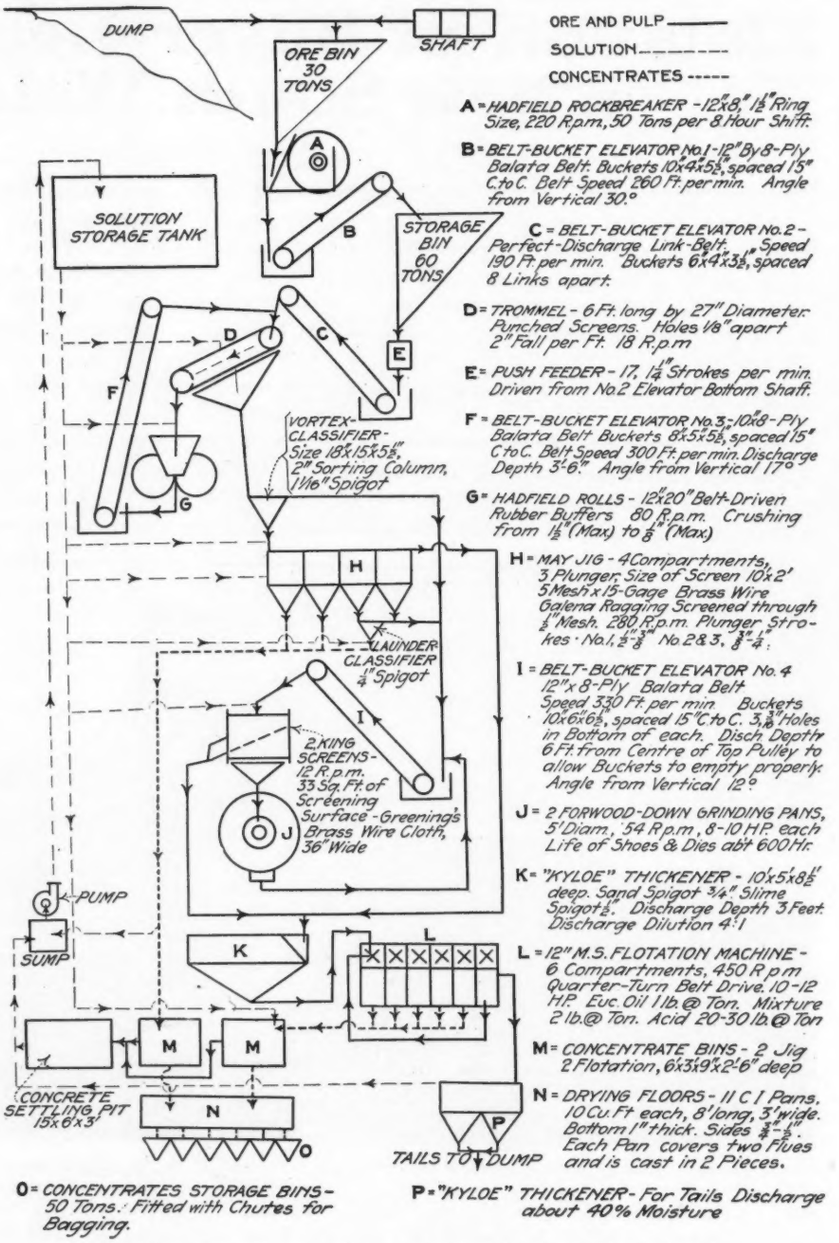
The average assay of the ore to be treated was about 30 oz. silver, 10% lead and 1 to 2 dwt. gold per ton. Because of the excessive transportation charges, the aim was to recover as much as possible of these metals in the form of high-grade concentrates. As the orebodies on the field were narrow and limited in extent, the company desired a mill of small capacity (about 50 tons per day) and small capital cost, which proviso precluded anything of an elaborate nature in the design. Several thousand tons of "seconds" had been mined during the opening up of the high-grade shoots of ore and lay awaiting treatment. The plan was to get the mill started and "tuned up" on this ore, supplementing it with ore from current development and, on results proving satisfactory, to mine the second-grade ore on an extensive scale. The flowsheet of the mill as erected is shown in the accompanying drawing.

The thickener before the flotation machine was of the inclined-baffleboard type already described.[1] They are cheap to build and simple and efficient in operation. The clear overflow from the thickener ran to the pump sump. The thickened underflow ran to a 6-compartment, 12-in. standard Minerals Separation machine. The tailings from the Minerals Separation machine ran to another thickener, the clear overflow from which ran to the pump sump, and the thick overflow into trucks and thence to the dump.

The flotation concentrates ran to a pair of bins, one being filled while the other was settling and being emptied. The turbid overflow from these bins ran to a concrete-lined pit where it was allowed to settle completely, the clear overflow from the pit running to the pump sump. This pit was cleaned out at intervals. After siphoning off the excess water from a concentrates bin, the sloppy concentrates were shoveled onto cast-iron drying floors and when dried sufficiently, into bins which fed chutes leading to the bagging floor.

The jig concentrates were handled similarly. On starting up the plant the first serious difficulty encountered was in the regrinding section, which could not handle the tonnage, when grinding to the degree of fineness required for good work at the flotation section. With the idea of lightening the load on the pans, the rolls were set hard up with considerable pressure between them so as to act by choke crushing. The increase in the quantity of slimes produced was immaterial owing to the ability of the flotation plant to handle this product efficiently. This readjustment made some improvement, but not sufficient to make up the leeway, and finally coarse screens had to be put on the King screening machines, increasing the aperture from 0.015 in. to 0.024 in. This resulted in a product altogether too coarse for good work at the flotation section, a point which must be kept in mind when considering the results.

The pulp as it left the regrinding section had a dilution of about 15 to 1 and before being treated at the flotation plant this was reduced to 4 to 1 in a Kyloe pulp thickener, the surplus water being returned by pump to the mill-water supply tank.


DUMP
ORE BIN 30 TONS
SHAFT
ORE AND PULP
SOLUTION
CONCENTRATES
A = HADFIELD ROCKBREAKER - 12"x8", 1½" Ring Size, 220 R.p.m., 50 Tons per 8 Hour Shift.
B = BELT-BUCKET ELEVATOR No.1 - 12" By 8-Ply Balata Belt. Buckets 10"x4"x5½", spaced 15" C.to C. Belt Speed 260 Ft. per min. Angle from Vertical 30.°
SOLUTION STORAGE TANK
STORAGE BIN 60 TONS
C = BELT-BUCKET ELEVATOR No.2 - Perfect-Discharge Link-Belt. Speed 190 Ft. per min. Buckets 6"x4"x3½", spaced 8 Links apart.
D = TROMMEL - 6 Ft. long by 27" Diameter. Punched Screens. Holes 1/8" apart 2" Fall per Ft. 18 R.p.m
E = PUSH FEEDER - 17, 1¼" Strokes per min. Driven from No.2 Elevator Bottom Shaft.
F = BELT-BUCKET ELEVATOR No.3 - 10"x8"-Ply Balata Belt Buckets 8"x5"x5½", spaced 15" C.to C. Belt Speed 300 Ft. per min. Discharge Depth 3'-6". Angle from Vertical 17°
VORTEX-CLASSIFIER - Size 18"x15"x5½", 2" Sorting Column, 1 1/16" Spigot
G = HADFIELD ROLLS - 12"x20" Belt-Driven Rubber Buffers 80 R.p.m. Crushing from 1½" (Max.) to ⅝" (Max.)
H = MAY JIG - 4 Compartments, 3 Plunger. Size of Screen 10'x2' 5 Mesh x 15-Gage Brass Wire Galena Ragging Screened through ¼" Mesh. 280 R.p.m. Plunger Strokes - No.1, ½"-⅜"; No.2 & 3, ⅜"-¼".
LAUNDER CLASSIFIER ¼" Spigot
I = BELT-BUCKET ELEVATOR No.4 12"x 8-Ply Balata Belt Speed 330 Ft. per min. Buckets 10"x6"x6½", spaced 15" C.to C. 3/8" Holes in Bottom of each. Disch. Depth 6 Ft. from Centre of Top Pulley to allow Buckets to empty properly. Angle from Vertical 12°
2 KING SCREENS - 12 R.p.m. 33 Sq. Ft. of Screening Surface - Greenings Brass Wire Cloth, 36" Wide
J = 2 FORWOOD-DOWN GRINDING PANS, 5' Diam., 54 R.p.m., 8-10 H.P. each Life of Shoes & Dies abt 600 Hr.
PUMP
SUMP
K = "KYLOE" THICKENER - 10'x5'x8½" deep. Sand Spigot ¾" Slime Spigot ½". Discharge Depth 3 Feet. Discharge Dilution 4:1
L = 12" M.S. FLOTATION MACHINE - 6 Compartments, 450 R.p.m. Quarter-Turn Belt Drive. 10-12 H.P. Euc. Oil 1 lb. @ Ton. Mixture 2 lb. @ Ton. Acid 20-30 lb. @ Ton
M = CONCENTRATE BINS - 2 Jig 2 Flotation, 6'x3'x9'x2'-6" deep
CONCRETE SETTLING PIT 15'x6'x3'
N = DRYING FLOORS - 11 C.I. Pans, 10 Cu. Ft. each, 8' long, 3' wide. Bottom 1" thick. Sides ⅜"-½". Each Pan covers two Flues and is cast in 2 Pieces.
TAILS TO DUMP
O = CONCENTRATES STORAGE BINS - 50 Tons. Fitted with Chutes for Bagging.
P = "KYLOE" THICKENER - For Tails Discharge about 40% Moisture

COMPLETE FLOW SHEET OF THE SILVER PEAK MILL

Oils Used in the Flotation Plant

The treatment at the Minerals Separation flotation plant involved the use of heat, acid and two oils. *Eucalyptus amygdalina* was used as an emulsifying agent and a dark lubricating-oil mixture to maintain the froth. The

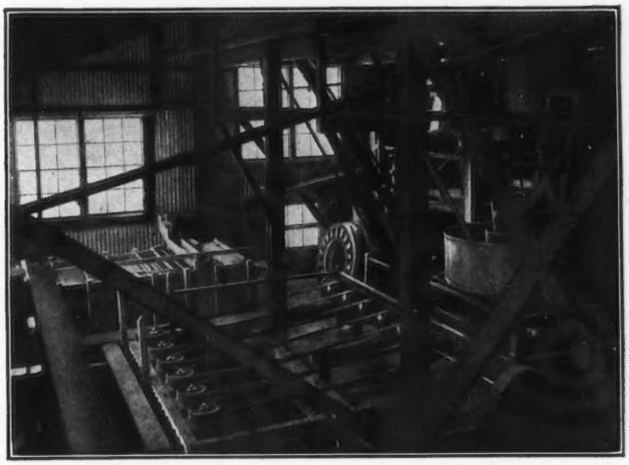
[1] "Flotation Process at Ryloe, N. S. W.," "Eng. and Min. Journ.," Dec. 7, 1912.

pulp was heated to 120° F. by live steam introduced into No. 1 agitating box. The consumption of steam was heavy, being equivalent to about 10 hp. (noncondensing) even when the initial temperature of the pulp was kept at about 90° F. by passing some of the mill water through the engine condenser.

The consumption of the different kinds of reagents varied considerably with the different kinds of ore, but the average was about as follows: Acid, 20 to 30 lb. per ton; *eucalyptus amygdalina*, ¾ to 1½ lb. per ton; mineral-oil mixture, 2 to 2½ lb. per ton. The sequence and method of using the reagents had to be altered from time to time to overcome difficulties that cropped up in the treatment.

Necessity for a Clean Water-Supply

One of the early difficulties encountered was of a peculiar kind and is well worth recounting. The water-supply for the mill was drawn from a dam, fed partly by surface drainage and partly by water from the mine. For four years previous to the commencement of milling operations this water supply had not been drawn on and had simply evaporated and soaked away. A few days



INTERIOR OF THE FLOTATION MILL

after starting the plant the water became discolored, first to a greenish yellow, then through yellow to a brick red. As soon as this reddish water arrived at the flotation plant the process went out of commission. The trouble seemed to be a total absence of aëration, which no amount of eucalyptus oil or other reagent could remedy. As much as 50 c.c. of eucalyptus oil was added to No. 1 agitating box at one time without producing any real froth or any signs at the back of the flotation spitz of the violent ebullition that is characteristic when the machine is in good working order. Occasional "blobs" of air came to the surface, but nothing in the shape of a froth.

The red discoloration was due to a fine precipitate which on analysis seemed to be a basic sulphate of iron. The precipitate was soluble in excess of acid, but the consumption made this remedy impracticable. The trouble was finally overcome, partly by keeping the mill solution in closed circuit and partly by manipulation of the reagents. Even with the closed circuit the loss by evaporation and leakage amounted to about 5,000 gal. per shift and this had to be made up with mine water.

This method of working led to another difficulty in the shape of scale and incrustations which formed chiefly in the Minerals Separation machine, but also in the screens and settler. In the flotation spitz the deposit took the form of sponge-like masses of crystals, while in the agitating boxes, in spite of the strong scouring action of the impellers, it was like a bad boiler scale. Both types dropped off at intervals and blocked the valves and pipes in the machine. At one period the trouble became so acute that it looked as if the plant would be a complete failure. The deposits were first noticeable when the solution contained only 450 grains of salts per gal. of solution, and up to a certain point they increased with the density of the solution. The incrustation appeared to be fine sand and slime bound together with sulphate of lime and magnesia.

At the King screens the meshes of the wire cloth became badly blinded. After a week or ten days the screening area became so reduced that the screens could not handle the tonnage, so the wire cloth had to be removed and cleaned by pickling in weak acid solution and then scrubbing with stiff wire brushes. The changing of the cloth on this type of screen is quite a tedious operation, and much time was lost thereby.

Samples of scale were assayed and showed in the deposit from the flotation spitz 61 oz. Ag and 14.5% Pb and in the deposit from the agitating boxes 16 oz. Ag and 3.5% Pb. The residue after evaporating filtered solution assayed 4 oz. Ag and 1.2% Pb, showing that small quantities of both silver and lead were being dissolved.

Device for Removing Floating Froth

The removal of the float from the surface of the flotation spitz presented another difficulty. When the machine was doing its best work the float was dense and heavy, being more of the nature of a thick scum than the usual frothy float composed of a fairly light mixture of bubbles and coagulated sulphides. The usual method in a case like this is to use paddles, but here they were ineffective as the float would not feed forward under the paddles. If the paddles were run fast and dipped deep, so as to cause a forward suction, the slime was stirred up and overflowed the lips with the concentrate, making it low-grade.

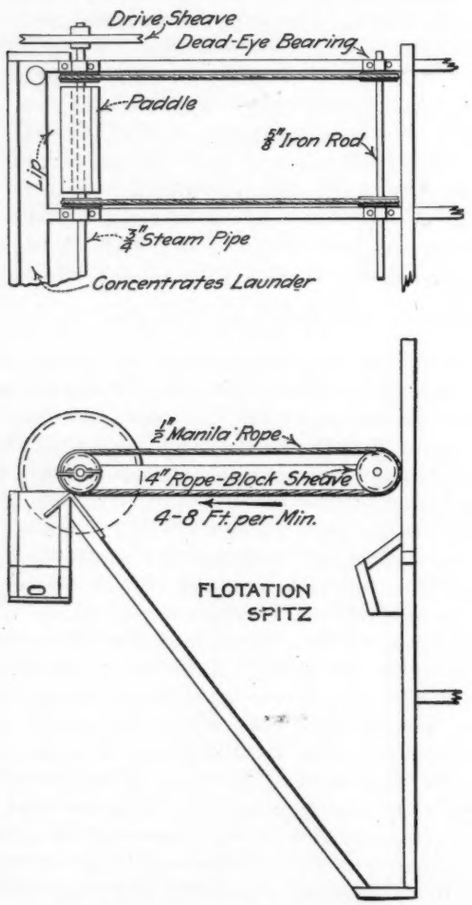
To overcome the difficulty the device shown in the sketch was put in. It consists simply of a pair of ropes traveling forward along both sides of the spitz. A ¾-in. pipe was run along the front of the spitz boxes, mounted on three simple bearings. To this pipe, 4-in. rope sheaves were keyed, two to each spitz. Along the back of the boxes a ¾-in. iron rod was run and another set of 4-in. sheaves threaded on and held in place by pins through the rod so that they could revolve freely without moving sideways. One-half-inch manila rope was spliced on over the sheaves. The ¾-in. pipe was driven at a very slow speed by a long rope from a slow-moving countershaft in the mill. Different-sized driving sheaves were kept handy so that the speed of the rope rabbles could be altered when necessary. It varied from 4 to 8 ft. per min. for the different classes of ore.

A coil of rope was kept handy, and a template was marked on a bench so that as the ropes wore they could be replaced rapidly by new ones. The ropes were put on with a rough long splice, and the men soon became expert enough to replace a rope in a few minutes. While one rope was out of business, the other did the work fairly well. Once the amount of shrinkage had been determined and allowed for, this characteristic of manila rope caused no trouble, its hairy nature made it effective, and this.

combined with its low cost, made it preferable to rubber or composition bands. After about 12 months, the back sheaves had to be renewed.

If the surface of the water was kept within ¼ in. of the lips these rope rabbles would feed the float into the launder, but as this close regulation of the water level was difficult, very small paddles were mounted between the sheaves on the front pipe so as to dip just behind the lips and touch the froth over.

The assays of the floats from the various spitz boxes are shown in Table 2. The overflow from No. 6 spitz was always, and that from 4 and 5 sometimes, returned to No. 1 agitating box for retreatment. A retreatment scheme for the whole of the concentrates in a separate machine, though highly desirable under the conditions, was not feasible—first, on account of the extra cost of



FOAM-REMOVING DEVICE

plant and treatment, and second, because the amount of concentrates produced (from 3 to 5 tons per 24 hr.) was not sufficient to keep a machine adequately supplied.

Washing Concentrates to Improve Grade

In spite of all precautions the bulk concentrate from the machine ran about 15% insoluble. To improve this a scheme for washing the concentrates in the settling bins was introduced. The bin was fitted with a number of inclined removable baffles, and behind the first one a heavy spray of cold water was played on the float. This had the effect of disintegrating it so that the sulphides, still in the form of coagules, settled to the bottom at the same time a portion of the floated gangue was carried over a lip by the slow-moving current of water. The solids in the overflow assayed 50 oz. Ag, 10% Pb and 70% insoluble.

The average value of the mill concentrates is shown in the table:

	Au., Dwt.	Ag., Oz.	Pb, %
In jig concentrates	6.0	69.4	21.5
In flotation concentrates	7.4	115.7	19.6

The mill tailings ran from 8 to 12 oz. Ag per ton, under 10 grains Au, and 2 to 2.5% Pb. The proportion of jig

TABLE 1. GRADING ANALYSIS OF REGRINDING SECTION

Grades	Energy Unit	Feed Weight %	Feed Total E.U.	Discharge Weight %	Discharge Total E.U.
— ⅛ + 12	10.7	25.8	276.06	....	....
— 12 + 20	15.0	24.2	363.0	....	....
— 20 + 30	17.0	11.7	198.9	0.4	6.8
— 30 + 40	18.0	6.6	118.8	4.0	72.0
— 40 + 60	19.5	7.7	150.2	24.3	473.8
— 60 + 80	21.0	4.0	84.0	15.5	325.5
— 80 + 100	23.0	2.6	59.8	9.1	209.3
— 100 + 150	24.0	1.4	33.6	4.9	117.6
— 150	27.5	16.0	440.0	41.8	1,149.5
		100.0	1,724.4	100.0	2,354.5
					1,727.4
				Difference	630.1

Tons per 24 hr., 33.6.
Horsepower, 16.0.

$$\text{Efficiency} = \frac{630.1 \times 33.6}{16} = 13.2$$

TABLE 2. ASSAY OF OVERFLOWS FROM FLOTATION BOXES

Box No.	Silver, Oz. per Ton	Lead, %	Insoluble, %
1	158.0	25.6	9.3
2	132.7	23.2	10.8
3	134.0	23.0	10.7
4	130.0	22.0	15.7
5	123.0	21.5	18.5
6	49.0	9.0	50.6

concentrates to flotation concentrate was about 2 to 1. The recoveries for the whole mill averaged only about 70% of the silver and 75% of the lead. In considering these low recoveries it must be remembered that during the period under review the plant was operating under two great disabilities—first, the inadequate regrinding facilities, and second, the fact that during the whole time, except for a few days toward the end, the plant was operated only one shift of 8 hr. per day. To give an idea of the importance of the former, a complete grading analysis of the feed and products from the flotation plant is given in Table 3. In columns 25 and 26 the recoveries made on each grade are given. Note the low recoveries on the coarser grades. It is not until the —100 to +150 grade is reached that anything like respectable recoveries are effected. The heads which remain on 80 screen contain 687.4 oz. Ag (by addition in column 5). The corresponding tailings contain 599.8 oz. (by addition in column 21), which represents a recovery of only 12.7%. The heads which pass an 80-mesh screen contain 1,285.6 oz. Ag, while the corresponding tailings contain only 312 oz., which represents a recovery of 75.7%.

Had the whole of the heads been ground to pass an 80-mesh screen, the —80-mesh product would have been enriched by 687.4 oz., bringing the total up to 1,937 oz.; while, assuming that the extra tonnage of —80-mesh product would not affect the recovery made on that grade (if anything it should improve it), the —80-mesh tailings would be increased by 34.3% of 687.4 oz., or 235.8 oz., bringing the total loss in the tails up to 547.8 oz., which would give a total recovery of 72.2% of the silver.

The recovery under the existing conditions was only 53.8%, so that by grinding the whole of the feed to pass an 80-mesh screen the recovery would have been increased at least 18%, making the total recovery for the mill about 90% of the silver. Unfreed values were not altogether

responsible for the losses due to the coarse crushing. Much of the free mineral itself was in pieces too large to be successfully floated. This was especially the case with the iron minerals and the finely crystalline galena. The large particles of coarsely crystalline galena appeared to float more readily. A good tailing of fairly coarse free mineral could be obtained by panning a sample of tailings which had been allowed to weather for some time so as to overcome the tendency of the sulphides to float off. So that better recoveries could have been expected if the sands had been passed over concentrating tables before being treated at the flotation plant. It would probably prove more economical to crush fairly fine, say not more than 15% on 80-mesh, and to table the sands, than to crush the whole product through 80-mesh and rely exclusively on flotation for the recovery of the sulphides. But here again, at this mill, the limited capital available was the governing factor.

Germans in the Metal Market

In the Court of Appeal, Nov. 18, 1915, Lords Justices Swinfen Eady, Phillimore and Pickford heard an appeal by Aron Hirsch & Sohn, metal merchants and smelters, of Halberstadt, in Prussia, from a decision of Justice Bray in an action brought against them by the Zinc Corporation, Ltd., of Copthall Avenue, E. C., says the London *Financial Times*. The action was for a declaration that a contract for the supply of zinc concentrates from certain mines in Australia to Hirsch & Sohn was void by reason of the war.

J. A. Compston, K. C., for Hirsch & Sohn, said that his clients had for a long time been taking the total production of zinc concentrates from certain mines in Australia. On the outbreak of war this action was brought. In it two questions were raised: (1) Was the contract one of a class which would be dissolved by the war? (2) If it were, was there not a clause in it which would suspend the operation of the contract during the war, and therefore prevent it being dissolved? Justice Bray held that this was a contract that would be determined by war. The second point gave him considerable trouble. He did not decide it and could say no more than that he inclined to the opinion that war was one of the things that would bring the suspensory clause into operation; but he said all that was suspended were future deliveries. That left in the contract clauses that would operate, and as they would necessitate communication with the enemy, the contract was void. On these grounds a declaration was granted, but without prejudice to all contracts and deliveries made before the war.

The hearing was adjourned.

TABLE 3. GRADING ANALYSIS AT FLOTATION PLANT

Grades by I.M.M. Screens	HEADS — 100 Tons (Assumed) — Weight of Heads %	Assay Values Ag, oz. @ T.	Assay Values Pb, %	Total Values per 100 Tons of Feed Ag, oz.	Total Values per 100 Tons of Feed Pb, Tons	Per Cent. of Total Values in Feed Ag	Per Cent. of Total Values in Feed Pb	CONCENTRATES — 5.8 Tons (from Average Assays) — Weight of Concentrates, %	Weight per 100 Tons of Feed, Tons	Assay Values Ag, Oz., @ T.	Assay Values Pb, %	Total Values per 100 Tons of Feed Ag, Oz.	Total Values per 100 Tons of Feed Pb, Tons	Per Cent. of Total Value in Feed Ag	Per Cent. of Total Value in Feed Pb	TAILINGS — 94.2 Tons (by Difference) — Weight of Tails, %	Weight per 100 Tons of Feed, Tons	Assay Values Ag, Oz., @ T.	Assay Values Pb, %	Total Values per 100 Tons of Feed Ag, Oz.	Total Values per 100 Tons of Feed Pb, Tons	Per Cent. of Total Values in Feed Ag	Per Cent. of Total Values in Feed Pb	Recoveries Made on Each Grade, Ag, %	Recoveries Made on Each Grade, Pb, %
25 + 30	0.4	12.0	1.5	4.8	0.006	0.24	0.2	0.5	.003	120.0	27.0	0.36	0.001	0.018	0.032	0.4	0.37	12.0	1.4	4.44	0.005	0.22	0.17	7.5	13.3
30 + 40	5.1	13.0	1.6	66.3	0.082	3.4	2.7	0.7	0.042	121.0	26.0	5.1	0.011	0.25	0.36	5.0	4.71	13.0	1.5	61.23	0.071	3.10	2.31	7.6	13.6
40 + 60	28.4	11.5	1.6	326.6	0.448	16.5	14.7	4.0	0.238	115.0	31.7	27.4	0.116	1.39	3.81	29.4	27.69	10.8	1.2	299.16	0.332	15.16	10.93	8.1	25.9
60 + 80	20.4	14.2	1.7	289.7	0.347	14.7	11.4	6.3	0.365	150.0	26.8	54.7	0.098	2.77	3.22	24.0	22.61	10.4	1.1	235.04	0.249	11.91	8.17	18.8	28.2
80 + 100	9.4	17.3	1.8	162.6	0.169	8.2	5.6	8.0	0.470	204.5	10.0	96.3	0.047	4.88	1.54	10.8	10.18	6.5	1.2	66.30	0.122	3.36	4.02	59.2	27.8
100 + 150	5.5	20.5	2.6	112.8	0.143	5.7	4.7	8.8	0.521	162.5	18.4	84.6	0.096	4.28	3.15	5.0	4.71	6.0	1.0	28.20	0.047	1.42	1.53	75.0	67.0
150 + ...	30.8	32.8	6.0	1010.2	1.848	51.2	60.7	71.8	4.172	190.0	31.6	792.7	1.322	40.17	43.48	25.4	23.93	9.1	2.2	217.49	0.526	11.02	17.29	78.4	71.5
Totals.....	100.0			1973.0	3.043	99.9	100.0	100.0	5.811		28.4	1061.4	1.691	53.76	55.59	100.0	94.2		9.68	911.86	1.352	46.19	44.42	53.8	55.6
Average totals..		19.73	3.04							182.6									1.44						

Method Used in Driving the Rogers Pass Tunnel*

The 5-mi. tunnel of the Canadian Pacific Ry. at the Rogers Pass summit of the Rocky Mountains (having its east portal 80.5 mi. west of Field, B. C.) will be the longest tunnel on this continent, and will be large enough for a double track.

The tunnel will be 26,400 ft. long between portals, on tangent, and will have a grade of 0.95% throughout. In section it will be 29 ft. wide at rail level, with vertical sides and semicircular roof. The height will be 21½ ft. from base of rail to crown, or 23 ft. above subgrade. Construction was commenced in September, 1913, and the contract calls for completion within 3½ yr. (by Dec. 3, 1916). This necessitates rapid and steady progress, and for this purpose a novel method of driving the tunnel was devised by the contractors and approved by the railway company's engineers.

Two Pioneer Side Tunnels Employed

To drive this long tunnel from the two ends only would have involved a protracted period of construction, and in order to expedite the work it was highly desirable to attack it at various points by means of intermediate headings. Shafts as used for tunnels at moderate depths were out of the question for this great Rocky Mountain tunnel. Nor were there opportunities for the use of adits such as have been employed in exceptional cases of side-hill tunnels.

The method devised was to drive from each end a pioneer tunnel or drift, parallel with the main tunnel, but about 50 ft. distant from it. From these two drifts lateral drifts or crosscuts are driven to the center line of the tunnel at intervals of 1,400 to 3,000 ft. From each of these points the main tunnel heading is driven, working usually in the upgrade direction. This method gives numerous points of attack on the main tunnel. The drifts serve for the removal of material by cars, the ventilation of the headings and the placing of pipes and cables clear of the tunnel construction work. The two pioneer drifts, however, are on opposite sides of the line of the tunnel, the drift at the east end being on the north side and that at the west end on the south side of the tunnel. Thus they cannot be extended to form a continuous pass-

*Excerpt from "Engineering News," Nov. 11, 1915.

age, and each drift will be somewhat shorter than the half length of the tunnel.

These drifts and crosscuts were intended simply to facilitate the work on the tunnel, and their construction is entirely at the contractors' expense. It was not intended to use them permanently.

The nearest approach to a previous use of this system in driving long tunnels was in the construction of the first Simplon Tunnel in Switzerland.

The pioneer drifts and crosscuts are of rectangular section, 8 ft. wide and 6 ft. 6 in. high. The main or central heading, also rectangular, is 11 ft. wide and 9 ft. high. Working from each portal, this main drift is being enlarged to the full tunnel section.

Driving the Drifts and Headings

To save time and excavation the pioneer drifts were started considerably above the grade of the tunnel heading. The drift at the east end starts about 50 ft. above grade and is practically level, so that the first two crosscuts slope down to reach the main heading.

In driving the pioneer drifts at the east end four Leyner drills are mounted on a bar. These put in about 24 holes 6 ft. deep, 1¼-in. top and 1⅛-in. bottom diameter. Each hole is loaded with from 4 to 8 lb. of 50% dynamite. Similar drills are used in the center bench, drilling rounds of 26 holes 6 ft. apart, or 225 lin.ft. per round. These sections or "rings" are shot off for muck as required.

For ventilating the faces of the pioneer drift and advance heading two exhaust fans of the Connersville type (with 12-in. wood-stave pipe) are used, placed usually near a crosscut. From this point the exhaust pipe is carried to within 25 ft. of each face. A gate is provided so that the fan can exhaust from either face as required. Only one of these fans is worked at a time, so that one can be moved while the other is in service. The fan is started at each blast, and the men can return to work in from 15 to 25 min. By opening the 1½-in. air line for the drills the smoke and fumes can be cleared away from the face so that they will be removed by the exhaust.

At the portal of each pioneer drift there has been installed a multivane fan 5 ft. in diameter, which forces air into the drift. This air is diverted into the main tunnel whenever required. For instance, after shooting in the enlargement to full tunnel section the air is turned in at a cross-drift beyond the point of shooting. In this way the smoke and gases are cleared out of the tunnel very rapidly.

Working Force and Staff

The force per 8-hr. shift in the pioneer drift is as follows: Four drillers (4 drills at each end), 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 to 4 mules and about 40 cars.

The force per 8-hr. shift in the advance heading of the main tunnel is as follows: Three drillers (3 drills at each end), 2 helpers, 8 to 10 muckers, 1 nipper, 1 driver, 1 shift boss, 1 mule, and 60 to 80 cars (according to the length of haul). In addition, there is the following force on each 10-hr. shift to cover the two small drifts in each end: One assistant superintendent, 1 walking boss, 2 blacksmiths, 2 blacksmith helpers, 12 laborers, 10 dump men, 6 teamsters, 14 mules, 1 hoistman and 7 pipe-fitters, carpenters, mechanics, etc.

The center bench of the main tunnel is worked in 8-hr. shifts with 7 to 10 drills, 7 to 10 helpers, 5 to 10 muckers, 1 shifter, 1 driver and 1 mule.

The completion of the main tunnel to full section is worked in 10-hr. shifts, with the following force per shift: One driller, 1 helper, 1 to 2 powdermen, 1 engineman and 1 craneman on the mucking shovel, 10 to 12 pit men at the shovel, 1 general foreman, 1 foreman and 12 to 15 laborers for the dump and track work, 2 compressed-air dinkey locomotives with 2 enginemen and 2 brakemen, 1 steam locomotive and 1 engineman, 1 fireman, 1 conductor and 2 car-repair men.

The contractors for the tunnel are Foley Bros., Welch & Stuart, of Winnipeg, and A. C. Dennis is the superintendent. The work is under the direction of John G. Sullivan, chief engineer, Canadian Pacific Ry., and W. A. James, engineer of construction.

The Explosion at Granite Mountain Shaft*

The explosion of 650 lb. of dynamite, which was loaded on a car and was about to be lowered down the Granite Mountain shaft of the North Butte Mining Co., caused the greatest loss of life that has resulted from any accident that has occurred in the history of Butte mining operations. This was due, mainly, to the fact that the explosion occurred shortly after 1 o'clock in the afternoon, when the shift bosses and nippers were waiting near the shaft to be lowered for the afternoon's work. Sixteen men were killed and four were injured.

Owing to the fact that all those who were near enough to the powder to have had any knowledge of the cause of the explosion were killed, any attempt to fix this cause is limited to pure conjecture. Among the many theories that have been advanced is the one that the powder may have been exploded by a rock falling from the headframe and striking it. However, the facts that the car was standing 25 ft. away from the collar of the shaft and that no skips containing ore or waste were at the top do not seem to support this theory. Experiments made after the accident also failed to indicate any such possibility. A stone approximately 2x4-in. in size, dropped from a height of 75 ft. onto a powder box filled with sawdust, caused only a slight indentation of the wood.

The explanation that now seems most plausible is that the car was struck by a stray rifle bullet fired by a person at considerable distance from the scene of the accident. The collar of the shaft is situated on an elevation at some height above the rest of the ground in the immediate vicinity, and it would therefore have been possible for a bullet coming from nearly any direction to strike the car. Boys are notoriously careless in handling guns, and unfortunately they and their guns are too common in the district.—The *Anode*, November, 1915.

The Largest Plate Mill in the World has been ordered for the Lukens Iron and Steel Co. at Coatesville, Penn. The exact length has not yet been determined, but it will be either 200 or 204 in. This compares with a 178-in. mill at Witkowitz, in Austria-Hungary, a 178-in. mill just ordered for the Imperial Steel Works of Japan, and a 168-in., two-high, reversing mill at the Dalzell works near Glasgow, Scotland. The Lukens mill will be four-high and provided with chilled working rolls 34 in. in diameter, supported both at the top and bottom by steel rolls 50 in. in diameter.

*See "Eng. and Min. Journ.," Oct. 30, 1915.

Natural Gas--Its Occurrence and Properties

By Dorsey Hager*

SYNOPSIS—A résumé of the geologic and commercial factors in the development of natural-gas deposits. Further development of the American fields is urged.

Natural gas is of course any gas formed in nature, such as marsh gas, sulphur dioxide, carbon dioxide (the "choke-damp" of the mines), sulphureted hydrogen and petroleum gas. However, as generally understood, natural gas is that obtained from oil or gas fields, and burned in our homes and factories instead of gases manufactured from coal or from petroleum.

The geology of natural-gas formations is now well understood. The chances for the occurrence of commercial natural gas in many untouched areas are so favorable, the efficiency and cheapness of natural gas are so much greater than other fuels, that I have wondered at the relative lack of interest of manufacturers in the possibilities of employing such a cheap fuel; and also at the lack of comprehension by gas men of the value of geology as applied to prospecting for natural gas.

Geographic Distribution in the United States

At present the chief productive natural-gas areas of the United States are in Kansas, Oklahoma, Louisiana, Pennsylvania, West Virginia and California. The Oklahoma and Kansas natural-gas deposits have been touched, but have not been developed as fully as the oil resources. Illinois, Indiana, Ohio, Kentucky, New York, Tennessee, Alabama, Texas, Wyoming, Montana, Utah and New Mexico also have small gas fields. Alabama, southern Tennessee, eastern Mississippi, Iowa, Missouri, and Arkansas have gas possibilities that should be developed.

ANALYSES OF NATURAL GAS

Sample—Where Taken	Methane, CH_4	Ethane, C_2H_6	Carbon Dioxide, CO_2	Nitrogen, N_2	Hydrogen, H	Other Hydrocarbons	Helium, He	B.t.u. per Cu.Ft.
1 Pittsburgh, Pa.	92.00	3.00	...	2.0	3	...	....	978
2 Midway, Calif. (Dry).....	92.00	.....	3.2	0.3	..	3.2	....	998
3 Hogshooter, Okla. (Dry)...	92.20	.....	1.0	4.8	..	...	....	1,003
4 Glen Pool, Okla. (Wet)...	38.75	61.10	0.2	....	..	...	....	1,551
5 Dexter, Kan...	14.85	0.41	...	82.7	..	...	1.84	Noncombustible

Gases 2 and 3 are dry gases. Gas No. 4 is "wet" or casing-head gas. [Gas No. 5 is peculiar in that it contains 82.7% of nitrogen and 1.84% helium.

Natural gas is composed principally of the hydrocarbons methane (CH_4, commonly called marsh gas) and ethane (C_2H_6). Two elements, carbon and hydrogen, are the chief constituents of all natural gas. The analyses of one exceptional and of four typical gases are presented in the accompanying table.

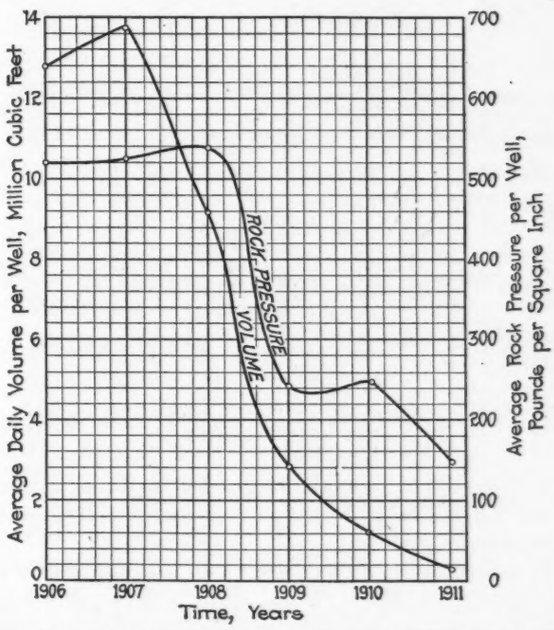
Origin of Natural Gas Uncertain

The origin of natural gas is shrouded in mystery. It may be of organic or inorganic origin—that is, formed by the decomposition of animal or vegetable matter—or it may be the result of the interaction of certain chemicals lying at great depths underground. Marsh gas is certainly due to decaying vegetable and animal matter, and it is not improbable that the natural gas from petroleum is also of the same origin.

Methane is the most stable of the hydrocarbons. It is highly probable that the heat breaks up the more complex hydrocarbons to form methane, so that gas is being continually formed in the earth wherever petroleum is found. It is not at all improbable that tremendous quantities of gas are formed in the change of lignite to bituminous coal and of bituminous coal to anthracite.

However, speculations along such lines lead to endless controversy, and for all practical purposes it is sufficient to note the occurrences of natural gas, and its economic importance, leaving speculations as to its origin to the ultra-scientists.

It is interesting to note that gas generally occurs in regions where lignitiferous, bituminous or petroliferous shales are found. The gas is generally found above the shales or in porous sand lenses interbedded in the shales. The relation of commercial accumulations of natural gas to shales is important, as one would not care to locate a well in regions where shales carrying organic matter are absent.



DECLINE IN VOLUME AND ROCK PRESSURE OF WELLS IN THE CANEY FIELD—AFTER BLATCHLEY

Ascent of the curves is caused by new wells being added to the field during intermediate years

Some commercial gas has occurred in glacial drifts in Iowa, Illinois and Kansas. The gas was in all likelihood marsh gas resulting from the decay of vegetation buried at shallow depths. It may also be possible to utilize the marsh gas formed in the Gulf Coast regions, where, if collected above ground, it would in some places have a distinct commercial value as fuel for houses. Tremen-

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dous quantities of decaying vegetation occur in the coastal plains, and the utilization of the marsh gas given off by that vegetation is only a question of time.

Natural gas occurs in formations of the most recent to those of the early Paleozoic, Ordovician and Silurian ages. In fact, gas seems to be found wherever decaying vegetation or animal matter has occurred. The presence of natural gas in the older beds presupposes earlier vegetable or animal life, unless the gas has migrated from younger beds. Commercial accumulations are, however, dependent upon the trapping of the gas.

Factors Affecting Commercial Deposits

Commercial deposits of natural gas are dependent upon two essentials—a source of supply for the gas, and proper reservoirs. The source of supply has been treated under origin, and the reservoirs will now be considered.

It has been ascertained by careful observation and study that most productive natural-gas fields occur in beds that have been folded into arch-like structures called domes, anticlines (see Fig. 1), or some modification of those structures, as terraces, noses or monoclines. Lensed conditions also tend to accumulations. (See Fig. 2.)

An arch-like structure, such as that in Fig. 1, is called an anticline. Under ideal conditions the gas accumulates

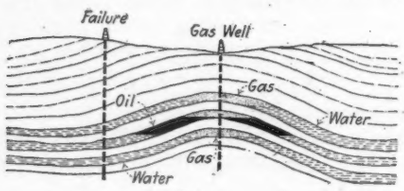


Fig. 1.

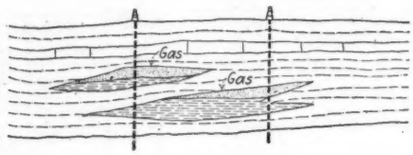


Fig. 2.

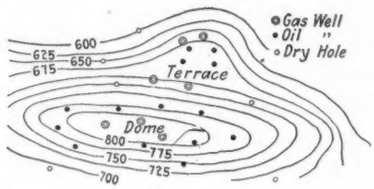


Fig. 3.

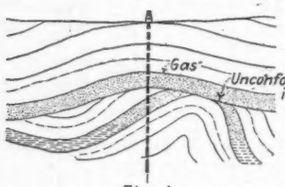


Fig. 4.

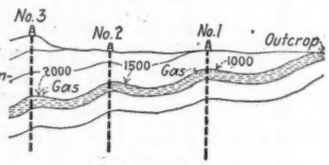


Fig. 5.

FIGS. 1 TO 5. DIFFERENT CONDITIONS OF NATURAL-GAS OCCURRENCE

at the top of the fold; oil, if present in the same sand, lies below the gas, and water below the oil, in the order of the specific gravities.

The foregoing is the ideal case. In many instances gas is found above or below the oil sands. Where it is found in an oil sand, the oil and gas are quite often so closely associated that the gas may be said to be held in compression in the oil. Fig. 3 shows an anticlinal or domed condition, with a terrace upon its flank. Gas occurs at the top of the fold and also, as will be noticed, where the dip changes so markedly, both above and below the terrace.

Any sudden break or change in the dip tends to cause an accumulation of gas. Porous rocks, sands, sandstones, limestones or fractured shales form good reservoirs for gas if they are overlain and underlain by relatively impervious beds of sandstone, limestone or shale. The covering and underlying beds must be such that gas cannot escape through them and be dissipated into the air. Where the beds carrying the gas are "tight," or closely cemented, accumulations at the tops of folds will not be very productive. The more porous the reservoir, the greater the volume of gas it can hold, and cementation closes the pore space. Where the structures were faulted or broken so that vents to the surface were opened, gas escaped from the beds.

In some cases the gas has, in all probability, migrated from lower beds to higher, owing to unconformities (see Fig. 4) or to faulting. Gas naturally travels wherever an opening is afforded and only comes to rest where there is a relatively impervious covering to prevent its escape. The covering may be a compact limestone, dense shale or closely cemented sandstone.

Gas generally occurs with oil, but there are many productive gas sands that do not carry oil. These are called "dry" gas sands, to distinguish them from the gases carrying petroleum vapors. Gas sands occur above or below oil sands (see Fig. 1); also in districts where no commercial oil sands are obtained.

Variations in Pressure

The pressures of gas vary in different fields and for different depths of gas sands. There is, however, a remarkably close relation between the gas pressures and the depths of the gas sands. Especially is this true in the Mid-Continental oil and gas fields and in West Virginia. A well (see Fig. 5) 1,000 ft. deep will have a gas pressure of 400 lb.; one 1,500 ft., 600 lb.; one 2,000 ft., 800 lb.; or approximately 40 lb. per 100 ft. A study of a large number of wells shows that the pressure is approximately equivalent to the pressure exerted by a water column the height of the well.

Allowance should be made for the differences in specific gravities of the water and for the differences in elevations between the surface water table and the elevations at the collars of the wells. A column of fresh water 1 ft. high and 1 in. square exerts a pressure of 0.434 lb. per sq.in. Underground waters in the oil and gas fields have specific gravities of 1 to 1.3, which would make the water much heavier. In calculating, however, one can disregard specific gravities and simply use 0.4 lb.; this lower figure allows sufficiently for the loss in theoretical head resulting from friction, differences in elevation of the water table, etc. A difference of elevation of 100 ft. between wells means 40 lb. difference in pressure.

Allowing for such irregularities the pressures are remarkably consistent; so much so that in regions like Oklahoma and Kansas the gas companies base their estimates of pressures and also figure the weight of fittings necessary to control the well upon this important relation.

For example, fittings for a well 1,000 deep need to withstand only 400-lb. pressure. A factor of safety of 2 gives 800 lb. Such fittings will, however, be unsafe with wells 3,000 ft. deep, where there is a pressure of $300 \times 40 = 1{,}200$ lb. per sq.in.

The point is raised that if water is holding in the gas, the water should replace the gas when the gas pressure is weakened. Such, in fact, is generally the case. The gas is withdrawn very rapidly. The water moves more

slowly through the pore spaces of the sand, owing to friction and adhesion, with the result that the gas pressures are reduced for a short time. By shutting in a well, however, the gas pressure rises again, showing that hydraulic pressure is back of it.

There is considerable question as to the cause of the pressure, but there is no doubt that the hydraulic theory holds with but few exceptions. There is such a close relation between the head of water and the gas pressure that I do not feel inclined to disregard the artesian theory, especially for sands which are exposed to meteoric waters. I fully realize that artesian conditions do not apply in all places. At Fort Smith, Ark., little or no water is found in the gas sand. Pressures of but 145 to 280 lb. per sq.in. instead of 400 to 800 lb., are obtained at depths of 1,000 to 2,000 ft. The sands, however, are nearly free of water.[1] The synclines carry gas in that field.

Maximum gas pressures of 1,260 lb. are reported[2] at Midway, Calif.; 1,500 to 1,700 lb. are reported[3] in Green County, Penn.

Calculating Gas Volumes

A few calculations will give some estimate of the capacity of rocks to hold gas; also the large acreage that must necessarily be drained by gas wells. We will assume as a unit, a sand 1 ft. thick, containing 10% of voids or pore space per cubic foot, and covering one acre. An acre-foot, or 43,560 ft. of sand, under the conditions cited contains $43,560 \times 0.10 = 4,356$ cu.ft. of pore space. If this space be filled with gas at atmospheric pressure it will contain 4,356 cu.ft. The specific gravity of gas compared to air varies from 0.5529 for methane, to nearly 1, the specific gravity of air. The higher the quantity of ethane and the more complex hydrocarbons, the higher the specific gravity. An average specific gravity of 0.6 is generally assumed.

Gas volumes are measured at an average mean atmospheric pressure of 14.4 lb. per sq.in. and at a pressure of 4 oz. (0.25 lb.) above the mean atmospheric pressure. The pressure approximately corresponds to 14.7 lb. at 60 deg. F., the pressure at mean sea level. Theoretically, the temperature at depth should be taken into account, but in an approximate calculation such refinements are of little value. The number of expansions for 100-lb. "rock" pressure would be $\frac{100 + 14.7}{14.7} = 7.8$. The total volume per acre-foot will be volume of gas times expansions, or $4,356 \times 7.8 = 33,976$ cu.ft. per rock pressure of 100 lb. At 500-lb. rock pressure the expansions are 35 and the volume per acre-foot equals $4,356 \times 35 = 152,460$ cu.ft. At 1,000-lb. pressure the expansions are $\frac{1,000 + 14.7}{14.7} = 69+$, instead of 78.0 as one would at first imagine, the added 14.7 lb. becoming of less consequence the higher the rock pressure becomes. The volume will be $4,356 \times 69 = 300,582$ cu.ft. per acre-foot.

Gas has such mobility that one gas well situated at the top of a dome should in time drain all the gas from the sand. Good practice, however, allows 100 acres of land per gas well. One well per 40 acres is the minimum of good practice. Allowing one well to drain 100 acres, a well, under the conditions given, would take care of 152,460,000 cu.ft., for a pressure of 500 lb. and a sand 10 ft. thick.

A single well often produces many times the theoretical amount. It is more than likely that petroleum acts as a solvent for the gas and holds tremendous volumes in solution, as the hydraulic pressures set up are not sufficient to liquefy the gas. As several wild gas wells have produced from 30,000,000 to 70,000,000 cu.ft. per day and kept it up for months, it is a matter of wonder as to where the gas came from.

The graphic chart[4] (Fig. 6) gives some idea of gas volumes in producing fields. This was taken at the famous Caney, Kan., gas field and shows the life of that remarkable field. The high average volume of 10,694,000 cu.ft. per well, with the rock pressure of 490 lb. per sq.in. shows that such wells must have drained a large area. The total volume of gas over a period of five years would be $10,694,000 \times 1,825 = 19,516,550,000$ cu.ft. If the value of such gas at the well is \$0.05 per 1,000 ft., the total value is $19,516,550 \times 0.05 = \$975,827.50$ per well. As such a well should not cost over \$5,000 to drill, one should obtain extraordinary returns on the money invested. Pipe lines are expensive, however, the leakage is large, royalties and overhead expenses are to be considered, and depreciation is rapid. While there are large profits in the natural-gas industry, the profits are none too large for the risks taken.

Heating Value of Natural Gas and Other Fuels

The value of natural gas in heating is approximately 1,000 B.t.u. per cu.ft. The higher the percentage of hydrocarbon gases, such as ethane, the higher the number of heat units. This is clearly shown in the analyses already given. Comparison with coal, petroleum, wood and producer gas is presented in another table.

COMPARISON OF NATURAL GAS AND OTHER FUELS

Fuel	B.t.u.	Equivalent in B.t.u. of 1,000,000 Cu.Ft. of Natural Gas	Value
Natural gas, per cu.ft..	1,000	1,000,000 cu.ft.	At 10c. per 1,000 cu.ft. $100.
Oil gas, per cu.ft.....	850	1,176,470 cu.ft.	At 25c. per 1,000 cu.ft., $294.
Producer gas, per cu.ft.	200	5,000,000 cu.ft.	At 5c. per 1,000 cu.ft., $250.
Petroleum, 14° Bé.....	18,500	160 bbls.	At $1 per bbl., $160.
Coal (bituminous), per lb.....	12,500	40 tons	At $2.50 per ton, $100.
Wood, per lb.....	5,000	66.6 cords (1 cd. 3,000 lb.)	At $3.50 per cord, $198

However, B.t.u. do not measure the true efficiency of gas. The efficiency of combustion of gas is greater than that of other fuels, so the actual efficiency will be 10 to 20% greater.

The development of the casing-head gasoline industry has sprung into prominence within the last five years. It has been found that gas coming directly off petroleum carries hydrocarbon vapors that can be condensed by pressure. These vapors consist of the lighter hydrocarbons that go to make up naphthas, benzine, gasoline, etc., having specific gravities of 70 to 100°. A rich gas may carry 5 gal. of gasoline per 1,000 cu.ft., but 1 gal. per 1,000 cu.ft. can be made to pay if a sufficiently large quantity of gas is obtained. The gasoline is first extracted, and the "dry" gas is introduced in the gas line for fuel.

[1] Carl D. Smith, Bull. 541, U. S. Geol. Surv.

[2] R. P. McLaughlin, "Pressures," Bull. 69, California State Mining Bureau, 1915.

[3] I. C. White, Vol. Ia, W. Va. Geol. Sur.

[4] "Waste of Oil and Gas in Oklahoma," Blatchley, U. S. Bureau of Mines.

High Wages and Steady Work a Cure for Butte Socialism

SPECIAL CORRESPONDENCE

The great improvement in conditions in the Butte mining district in the past year called forth from the mayor of the city, Charles H. Lane, a special Thanksgiving proclamation in which he calls attention to the facts that at present Butte has the largest number of men working in its mines ever known and that the payrolls are the largest, the community the most contented and happy and the reasons for thankfulness greater than ever before.

The improvement in labor conditions in the past year has been marked. It is just a year since the Anaconda and other large mining companies announced their intention of employing men without regard to their labor-union affiliations. The companies took the position that the men might belong to any union they chose or no union at all, but the question would not be raised or recognized. At the same time the companies made the pledge that labor conditions would not be allowed to become worse under the open-shop system than under the old one and pledged themselves to adhere to the union scale in effect.

They have carried out this promise with the result that the high price of copper makes the Butte wage scale today $4 per day of 8 hr. for every man in the mines, as against $3.50 that was being paid under the old régime. The men are well satisfied, and the efforts of foreign agitators to gain a foothold here have met with no success.

Socialism, which was so powerful that it held the reins of city government for four years and came near to getting control of the county government, is dying out, and while the socialists still maintain their organization, they have few members compared with former times. High wages and steady work for all have proved a good remedy for socialism.

Butte miners and mining companies are watching with interest for the completion of the improvements at the Washoe and Great Falls smelteries, as they anticipate that there will be a large increase then in the amount of ore handled from the mines of Butte. This will mean quite an addition to the force of men employed here, and the prediction is freely made that Butte's mine payrolls will comprise 20,000 names before the end of the winter.

Mount Lyell Mining and Ry. Co.

Announcement was made some time ago of the new rich ore encountered in the properties of the Mount Lyell Mining and Railway Co., Ltd. The recent report for the half-year ended Sept. 30, 1915, states that prospecting work has disclosed considerable additions to the South orebody and large accessions to reserves in No. 40 and No. 41 stopes in the North Mount Lyell mine, which continued to yield high-grade ore. The crosscut at the 1,200-ft. level of the North Mount Lyell mine was driven 54 ft. through rich ore, which is still in the face.

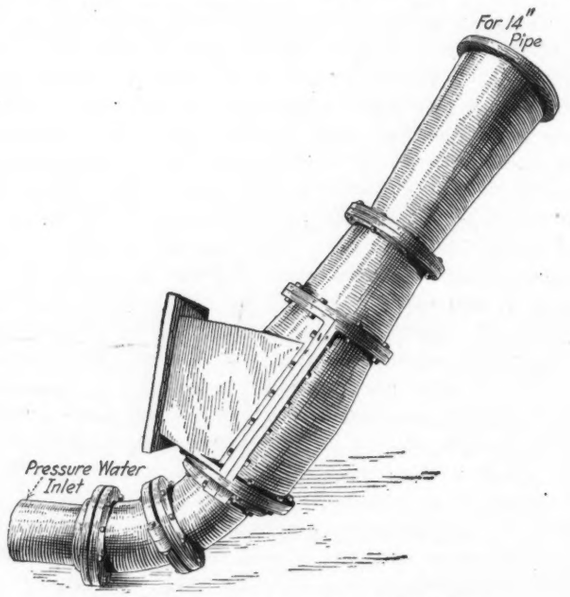
The ore reserves of the Mount Lyell mine were given as 1,791,479 tons; North Mount Lyell mine, 973,210 tons, not including important additions disclosed by development work. The cost of producing blister copper for the half-year was 18s. 7d. ($4.52) per ton of ore. During this period 4,053 tons of blister copper was produced. The net profits were £139,071, after writing off £20,123 for depreciation, £14,656 for prospecting and development work, and £18,400 for Federal and state income taxes. The saving from the full use of the Lake Margaret power installation was partly offset by the greater consumption of coke and the increased cost of supplies.

The flotation plant is being erected and is expected to start work during the current half-year. Options have been acquired on some West Coast mines owned by the Hercules Gold and Silver Mining Co., the Primrose Mining Co. and the Tasmanian Copper Co. Flotation tests of these ores on a commercial scale have been arranged for at Broken Hill.

Hydraulic Mining at Circle

BY HUBERT I. ELLIS*

In the *Journal* of Dec. 19, 1914, there appeared a short article, "Hydraulic Mining at Circle," describing the operations of Theron E. Fell on Mastodon Creek, Circle district, Alaska. Through the courtesy of Mr. Fell I have recently obtained additional data, which are given here.



SKETCH OF HYDRAULIC ELEVATOR

The Mastodon Creek ground is tight, contains much clay and many comparatively large rocks, and is difficult to work by pick-and-shovel methods. The cost of hydraulicking with water under a head of 100 ft. averages about 25c. per cu.yd. When using a 175-ft. head the plant washes 500 cu.yd. of material per day at a cost of 17c. per cu.yd. All giants except the one used in the tailings are of the No. 1 size, having a nozzle orifice of 2 in. The tailings giant is a No. 2, with a 3-in. orifice.

The general layout of the plant is illustrated in Fig. 1. The giants and boxes are first set as shown by the full lines. A sort of wing-dam is built, baffle boards are put on the boxes, and the gravel is driven into the boxes from one side. When this side of the cut is clear the large rocks are wheeled forward to provide drainage for the cut. The

*Kellogg, Idaho.

boards are then changed, and the other side is cleaned. This leaves only a ridge of gravel under the boxes when the cut has been finished, and this is blown upstream to the ground in the next cut. Bedrock is washed clean upstream with the tailings giant after the boxes have been removed. When all the material possible has been blown into the boxes from the first setting and bedrock has been

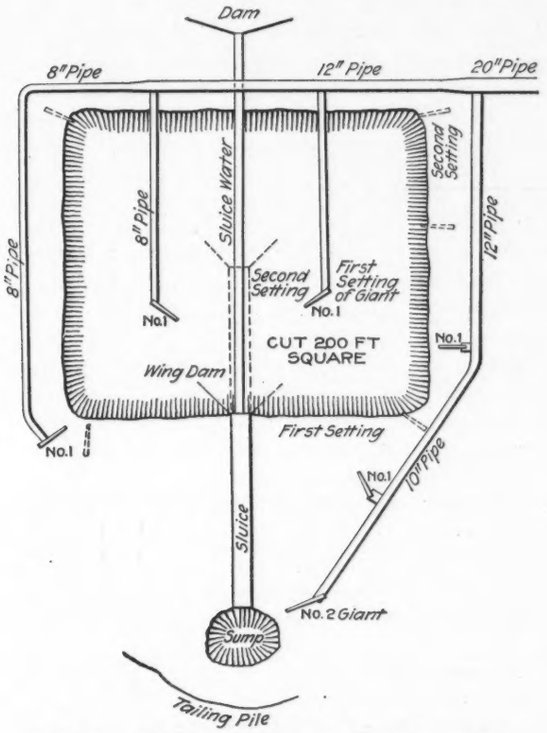


FIG. 1. PLAN OF FALL, HYDRAULIC MINE

cleaned, new boxes are added to the upper end of the string and the giants are reset in the positions shown by the dotted lines.

Some difficulty has been experienced in disposing of the tailings. At first an inclined chute and a No. 2 giant were used at the dump, but where the gravel contains but little sand the tailings are now simply blown up into a pile with the giant.

The chute method, *A* and *B*, Fig. 2, is illustrated. The chute is 4 ft. wide and has 3-ft. sides. The bottom is

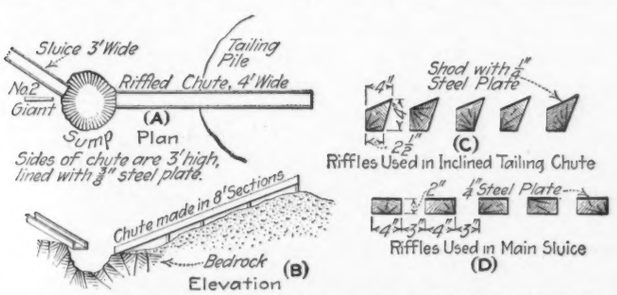


FIG. 2. INCLINED CHUTE FOR TAILINGS DISPOSAL

fitted with beveled steel-shod riffles, shown at *C*, set at an angle that will keep the gravel from rolling back into the sump. This method is better than the other when the gravel contains a considerable proportion of fine sand and pebbles that the water will carry away. It also serves to keep the water from washing back small rocks that have been blown up out of the sump.

The proportions of a tailing pile are shown in Fig. 3. This is made by simply blowing the gravel up with the giant working under a 100-ft. head, no chute of any kind being employed. Experience has shown that the tailings can be stacked in this manner to a height equal to

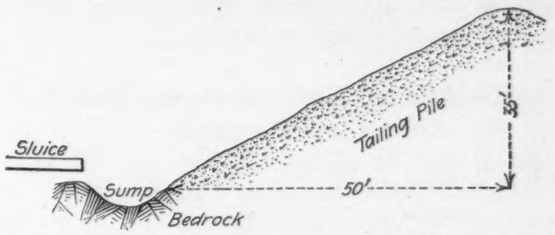


FIG. 3. SECTION OF "BLOWN-UP" TAILINGS PILE

one-third of the head on the giant at a distance from the sump equal to one-half the head. There is no difficulty in handling rocks half the size of a kerosene can by this method, and it is much more economical of water than the hydraulic elevator and more efficient for some classes of material than the inclined chute.

Butte & Superior Report

The Butte & Superior Copper Co., Ltd., reports results for the third quarter of 1915 as follows: Dry tons of ore milled, 130,210; average zinc contents, 17.147%; average silver contents, 7.6027 oz. per ton; zinc concentrates produced, 37,396 tons; average zinc in concentrates, 55.1279%; total zinc in concentrates, 41,230,885 lb.; average silver in zinc concentrates, 21.9646 oz. per ton; mill recovery (zinc recovered in concentrates), 92.3322%; mining costs per ton, $3.4584; milling costs per ton, $1.7652; total cost per ton, mining and milling, $5.2236.

The tonnage of ore treated was the largest of any quarter in the company's operations. In addition there was an increase of 2.8% in the recovery and an improvement of 2.4% in the grade of concentrates produced. The Black Rock shaft was continued to a depth of 1,759 ft., a station cut on the 1,700-ft. level and a skip pocket installed on the 1,600-ft. level. Preparations are being made to sink a new working shaft of greater capacity than the present one, designed to fulfill mining requirements to much greater depths than could be economically served with the present shaft. The new shaft will be entirely out of the orebody and, when completed, will release large bodies of ore adjacent to the present shaft, which cannot safely be mined during its use as a main oreway. Underground developments for the quarter were satisfactory in every way. Extensions of the orebody were disclosed in an easterly direction on all of the principal lower levels where work is now being conducted. No recalculation of ore reserves was made as applying to the third quarter, but it may be said that the new ore reserves developed were practically equivalent in quantity to the ore mined.

Financial results for the third quarter were as follows: Net value of zinc concentrates (at mill), $2,997,128; net value of lead concentrates (at mill) and of residues, $228,111; miscellaneous income, $14,716; total gross operating returns, $3,239,955; operating costs, $679,625; profits, $2,560,330, together with a further profit of $201,510 due to the excess received from the sale of con-

centrates and smeltery residues over the values at which these products were estimated in the monthly statements. At the end of the quarter and after payment of the dividend at that time, the company states that it had on hand approximately $5,000,000 in quick assets, consisting of cash and products conservatively valued in process of treatment and in transit.

Radium Extraction from Carnotite

Bulletin 104, "Extraction and Recovery of Radium, Uranium and Vanadium from Carnotite," by Charles Parsons, R. B. Moore, S. C. Lind and C. C. Schaefer, has just been issued by the Bureau of Mines. This Bulletin gives the results of the coöperative work with the National Radium Institute and describes the methods of extracting radium from carnotite ore as carried out in the plant at Denver.

The methods devised have proved highly successful. They depend essentially upon the fact that strong hot nitric acid has a high solubility coefficient for radium and barium sulphates. This enables the carnotite ores to be treated directly with hot nitric acid, removing the radium therefrom at a single operation. The method follows in brief:

The carnotite ore pulverized to 20-mesh is treated in an earthenware leaching pot with 38% nitric acid, 500 lb. of ore being used to 121 lb. of 100% HNO_3. The acid is brought near to boiling by means of steam passed through a glass tube and the ore gradually stirred in. Heating is continued for 15 min., when the acid is filtered from the ore in a stoneware filter. This is followed by a second treatment in the same leaching pot with somewhat weaker hot nitric acid, after which the whole is washed with hot water. Nearly all of the uranium, about 50% of the vanadium and over 90% of the radium are carried into solution by this method and separated from the bulky residues, which are then discarded. The acid solution is nearly neutralized with sodium hydroxide and barium chloride and sulphuric acid added in proper quantities and held in settling tanks with conical bottoms for three days to settle out the radium-barium sulphate. The supernatant liquid is then siphoned into an excess of boiling sodium-carbonate solution to separate the uranium and vanadium from iron, aluminum and calcium. The radium-barium sulphate left in the tank is run onto a stoneware filter, filtered, washed and dried, the washings being also added to the sodium-carbonate solution already mentioned.

The soluble sodium-uranyl carbonate and the sodium vanadate are filtered from the iron-calcium precipitate in filter presses and run into uranium-precipitation tanks. The sodium carbonate is then nearly neutralized with nitric acid and sodium hydroxide added to complete precipitation of the uranium as sodium uranate. The filtrate containing the vanadium is carefully neutralized with nitric acid and iron sulphate added to precipitate vanadium as iron vanadate. Both the sodium uranate and the iron vanadate are separated from their solutions by means of filter presses. The filtrate from the iron vanadate consists almost wholly of a solution of sodium nitrate containing, of course, a small amount of impurity. This filtrate is evaporated, sodium nitrate recovered and used again for the manufacture of nitric acid. The radium-barium sulphate, without further treatment, is reduced in large graphite crucibles by charcoal, a very efficient conversion (90 to 95%) into barium-radium sulphide being obtained. The sulphides are dissolved in hydrochloric acid and the residue of unchanged sulphates re-treated.

The chloride solutions are crystallized in the plant in silica-lined kettles, care being taken to keep the solutions acid with hydrochloric acid, as the separation of radium from barium is much more rapid under these conditions. The concentrated chlorides carrying from 4 to 10 mg. of radium per kg. are taken to the laboratory, filtered from any insoluble impurities and crystallized again in strong acid solution until the bulk has been reduced to a small volume, when they are converted into bromides. This is done after first neutralizing with ammonia and precipitating with hydrogen sulphide to remove lead, which always accumulates and which is not precipitated by hydrochloric acid from strong barium-chloride solutions. After removal of the lead, the barium and radium are converted into carbonates by the addition of ammonium carbonate, washed, and dissolved in hydrobromic acid. From this point on crystallization takes place in pure quartz dishes in solution strongly acid with hydrobromic acid.

The fractional crystallization of radium from the original chlorides to the finished product is neither tedious nor difficult, but takes place rapidly when acid solutions are used and proper apparatus is available which will withstand their action. The efficiency of the process is high.

In connection with the radium plant a nitric-acid plant has been erected which produces over 5,000 lb. of nitric acid per day. Owing to the recovery of sodium nitrate, the cost of the nitric acid used has been very low, averaging under the present cost for nitrate slightly less than 2½c. per lb. To Sept. 1, 4,774 mg. of radium was produced in the form of sulphates and 1,947.5 mg. of element had been delivered in the form of bromide. Deliveries are continuing at the rate of 300 to 400 mg. per month.

Flotation at Cripple Creek

Flotation will replace the cyanide process in the Independence plant, at Victor, Colo., according to a report published by the *Daily Mining and Financial Record,* Denver, Nov. 27, 1915. The plant is now being remodeled, and next week the company will commence the construction of a sampler of large capacity. This sampler will be for the low-grade ores exclusively and will not compete with the samplers now in operation in the district. The sampler will be run in conjunction with the mill, and all the rock will be passed through the sampler crushers direct to the chilean mills, where the final grinding for flotation treatment is accomplished. The chilean mills will be supplemented by ball mills which will reduce the ores to a degree of fineness not hitherto attained.

By the flotation process the company feels assured that it can successfully treat ores of a lower grade than has heretofore been possible. There are millions of tons of dump ore that can be successfully handled and in addition, the boon to the leasers and prospectors of the camp will be inestimable in that these men will be enabled

to sell their low-grade ores at a sufficient profit to pay at least a part of their expenses and thus be able to continue development work which may result in the opening up of better ores.

Arrangements have been made with the railroads for the hauling of the ores from all parts of the district, and surveys for tracks to the sampler have already been made. The Portland company has under consideration the provision of an adequate supply of 50-ton steel dump cars that will be unloaded automatically. Under this plan, from the time the rock is dumped from the cars until the tailings are run on the dump the progress of the ores through the mill will be automatic.

The mill will have an initial capacity of 1,000 tons a day, with the probability that a much larger tonnage will be reached eventually, provided the Portland company secures the coöperation that it has every reason to expect.

The problem of successfully handling the low-grade ores of the gold camp has always been recognized as one of prime importance, and it is now believed that the solution of the problem will be achieved by the flotation process, which represents the latest word in scientific treatment.

Gold Dredging in Philippines

The rapid increase in the gold production of the Philippines during the last few years has been noteworthy. In 1910 the gold output was valued at 308,860 pesos; in 1914 it was 2,349,267 pesos. Gold dredging has played a prominent part in this advance and is likely to be still more important, as additions are being made to the dredging fleet. According to the statistics just announced by Wallace E. Pratt, chief of the Division of Mines, the dredges were responsible last year for nearly 44% of the total gold output. Eight dredges were in operation, seven of which were in the Paracale-Mambulao district of Ambos Camarines and one was on the Umari River in Tayabas Province on the east coast of Luzon.

The Gumaos Placer Co. operated continuously throughout the year. Its dredge, built by the New York Engineering Co. and described in previous numbers of the Bureau of Science bulletin,[1] has achieved an enviable record during the period over which its operation extends. On an original investment of 500,000 pesos ($250,000), the company has paid in dividends during 27 months of operation the sum of 535,000 pesos, or 107%. The generally nonuniform character of the dredging ground in this district is exemplified in the record of the Gumaos dredge; the average value per cubic meter for different monthly runs varies from 6 centavos to 1.66 pesos. The average value for the whole period of operation has been 64 centavos per cubic meter. The cost of operation, according to the company's figures, is about 24 centavos per cubic meter dredged. The average fineness of the bullion smelted is 873. The depth of bedrock varies up to 17 m., but has averaged about 11 m. The gold recovered is fine and is very sharp and angular. It is confined to a layer of wash usually less than 2 m. thick immediately overlaying bedrock; the overburden is largely clay. . . . [The total gold recovered, to the end of 1914, by this dredge is valued at 912,205 pesos.]

[1] "The Mineral Resources of the Philippine Islands for the Year 1914," Division of Mines, Bureau of Science, Manila, P. I.

The Paracale Bucket Dredging Proprietary, Ltd., and the Philippine Dredges, Ltd., closely associated Australian corporations, had four dredges at work during 1914. One of these started in November, and another lost a great deal of time as a result of litigation over title to the ground upon which it was situated. In spite of obstacles, however, the year's record was good, and much credit is due William Telford, the general superintendent for the two companies.

The Malaguit Dredging Co. placed a new dredge on Malaguit River early in 1914. Some time was lost in getting into proper running order, but the dredge recovered a gratifying amount of gold and will undoubtedly do better as the operation becomes established.

The Philippine Dredging Syndicate and the Maximelo Dredging Co. each operated one dredge in 1914. About the middle of the year the former company finally dismantled its old Risdon dredge, which was built in Masbate in 1905, moved over to the Paracale district in 1908 and has been digging on Malaguit River since that time.

The Mambulao Placer Co. is reported to have obtained exceptionally high results from the tests of its dredging property at the head of Mambulao Bay, and a New York Engineering Co. dredge will be erected at Mambulao during the coming year.

Several dividends were declared by the dredging companies during the last year, and the industry appears to be in a healthy condition. The year 1915 should show a materially increased gold production. New dredges are under construction for some of the operating companies at Paracale, and the Mambulao Placer Co. will enter the dredging field, although it may not begin to produce until early in 1916.

Results at La Grange Improving

The operations of La Grange hydraulic mine in Trinity County, California, which has been in *borrasca* for several years, showed an improvement this year over the 1914 results despite the fact that the season was unfavorable climatically. In July the southern, or richest, part of the mountain became accessible, and by confining operations to this section, the company's engineers expect that henceforth profitable results will be obtained.

This year the water supply, which at the beginning of the season promised to be as large as that of any previous year, turned out to be less than for any season in the history of the company. This was due to breaks in the aqueduct, resulting from exceptionally heavy falls of snow and unusually cold weather in August. However, the mine paid its expenses though up to July 1 the richest part of the deposit had been inaccessible.

Chippewa Falls Power Development

BRAINERD CORRESPONDENCE

The Wisconsin-Minnesota Light and Power Co. has applied to the Railroad Commission of Wisconsin for permission to construct a dam across the Chippewa River above Chippewa Falls. The dam will develop a head of 60 ft. and provide 43,000 hp., and it will be the largest power-development plant in Wisconsin. The proposed construction involves an expenditure of upward of $2,000,000. The company is capitalized at $10,000,000.

Details of Practical Mining

Leyner versus Piston Drill

By L. P. Gordon

The accompanying table shows a comparison between Leyner and piston drills. These data were taken from accurate records of the opening of new sublevels in a mine of one of the large operators in the Iron River district. The drills operated under the same conditions, namely:

1. Ore extremely coarse, "fitchery" and hard, requiring one set of steels, and more at times, per hole.
2. Mounting—Upright double-jack post with arm and clamp.
3. Drifts, 6x7 ft.
4. Uniform air pressure and hoses according to size of air inlets in drills.
5. Broken ore handled by trammers on opposite shifts.

Type of Drill	Men Shifts	Labor Cost*	Drift Feet	Drill Shifts	Drift Feet per Drill Shift	Holes Drilled	Average Depth of Holes, Ft.	Feet Drilled	Feet Drilled per Drill Shift	Average Labor Cost per Drift Foot*	Average Earnings per Man per Shift
Leyner	448	$1299.20	906	224	4.05	3226	5	16,160	70	1.43	2.89
Piston	298	809.39	261	149	1.75	1139	5	5,695	38	3.10	2.71

*Includes rigging and blasting.

The Leyners were used to great advantage in stoping, particularly in drilling slice and upper holes, and they handled 12-ft. steel with ease in down or stope holes. A tripod with an adapter plate fitted in the saddle was used as a mounting in drilling on the benches.

Deterioration of Hoisting Ropes*

There may be said to be five ways in which deterioration of a rope proceeds: First, there is frictional wear; second, there is breakage of wires due to inequalities in even the best material; third, there is the breakage caused by the stress of bending over sheave and drum; fourth, there is corrosion inside and out; fifth, there is fatigue of the steel caused by its passing its elastic limit and accelerated by bending and by rapid hoisting. All of these effects finally take the form of broken wires. For this reason the appearance of broken wires is considered the best single sign to follow in deciding when to discard a rope.

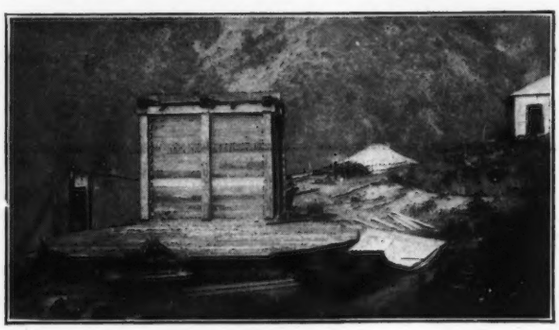
The manner in which breaks occur is of significance. Thus when a new rope is installed there is likely to be a short period, while the rope is taking its set and equalizing tension, during which breaks are relatively frequent. These breaks are of no importance and do not indicate that the rope is wearing out. After the period of their occurrence, the rope will run for some time without more wires breaking. Toward the end of the life of the rope, however, it may happen that the number of breaks begins to increase rapidly. Thus inspection on one day may show one wire broken at a certain point. The next day two may appear there and the third day, three or four. This condition arising is a sign that the rope is going to pieces and should be taken off forthwith. It may also happen that breaks occur before any great wear is visible—this, of course, after the period of initial breaking. Breakage without wear indicates faulty installation of some kind; either the rope is made of brittle wires or it is being bent over too small a drum or sheave.

*Abstract from Bulletin 75, U. S. Bureau of Mines.

A Wooden Ore Bin with Concrete Bottom

By C. M. Eye*

In order to avoid difficulties, encountered in the tropics, from rapid decay of wooden bottoms in ore bins, as well as to secure the maximum storage capacity, the bin shown in the cut was designed for the new 10-stamp mill of the Benguet Consolidated, at Antimok, Benguet, P. I. The base consists of a frame of 12x12



WOODEN ORE BIN WITH CONCRETE BOTTOM

timbers, rodded together, on which the 12x12 posts rest in daps, secured by steel pins 7/8x12-in. (Mortise-and-tenon joints were avoided on account of certainty of decay, due to water collecting in the mortises). All joints were well painted with asphalt paint, and base timbers were well tarred with hot coal tar.

Cross-timbers at the top are all 12x12, with two 12x16 timbers for the crusher. The bin is lined with 3x12 plank, all placed horizontally and cribbed at the corners. The bottom consists of 9 in. of rock, laid dry, with dry sand poured in and tamped, on which is laid 3 in. of concrete, bringing the floor level with the top of the base frame. The front of the bin rests on the retaining wall back of the stamps, with a 45° slope to the chutes to the feeders. The conformation of the site allowed placing the bin at a relatively greater height above, and distance from, the batteries, thus avoiding overhang and thrust. There are no connecting timbers between the bin and battery posts, the latter being braced by 12x16 timbers set in the retaining wall.

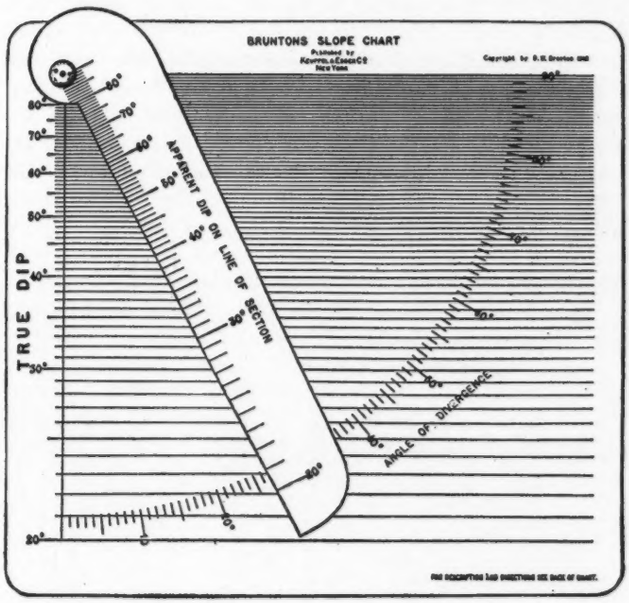
*Bagnio, P. I.

The inside dimensions of the bin as finished are: Width, 11 ft.; length, 14 ft.; height, 13 ft.; content, 2,000 cu.ft.; capacity, 100 tons, with broken ore at 20 cu.ft. per ton. The cut shows the structure as completed and the completed foundation platform for 25-ft. solution storage tank.

This bin is an exceedingly easy one to construct and secures the maximum of capacity with minimum of material.

The Brunton Slope Chart

The Brunton slope chart is a device for the determination of the apparent angle of sections when cut at planes of varying degrees of divergence from the dip. The chart enables the user instantly to obtain the apparent dip from the true dip, or *vice versa;* mechanically solving the equation, *tan C = cos A tan B,* in which *C* is the apparent dip, *A* the angle of diversion, and *B* the true dip.



BRUNTON SLOPE CHART FOR SOLVING EQUATION TAN C = COS A TAN B

In addition to its utility in the preparation of maps and geological sections, the chart is also useful for giving the valley angles in hoppers, ore bins, etc. It is published by the Keuffel & Esser Co., Hoboken, N. J.

Underground Toilet Systems

Passed Assistant Surgeon A. J. Lanza of the Bureau of Mines in Technical Paper 105, on "Pulmonary Diseases Among Miners in the Joplin District, Missouri," gives the following regarding underground toilet systems (or lack of them) at small mines. It offers good suggestions on a troublesome subject.

There is no established toilet system underground in the Joplin district. Many of the mines are small, employing 25 or 30 men and less, and the necessity for the toilet systems seen in large mines does not exist. As in other mining districts, there is a strict rule against ground pollution in the mines, a rule that, as elsewhere, is not infrequently broken. In some of the mines visited there was much evidence of this abuse, and in spite of the efforts of operators and ground bosses, there are always, from time to time, infringements of the rule. It does not seem at present that there is any pressing need of establishing toilet systems underground, though they might prove useful in some of the large mines in the district. In these latter, one sanitary privy underground would be a convenience and tend to check ground pollution. Such a privy could be cheaply constructed having removable containers (empty powder boxes with a layer of sawdust within) that could be hauled to the surface daily and burned. This is a cleanly, cheap and efficient toilet system where only a small number of men are employed.

In this connection, comment on mine privies is not out of place. At most of the mines there are privies on the surface, within easy access of the shaft or the change house. Some of these are clean and well kept; others are not clean, are not well kept, are in disrepair and are a nuisance in every respect. Wretchedly insanitary privies are only too common everywhere in this district, and those seen at the mines were often no exception to this rule.

Some Safety-Fuse Pointers*

The most important part of safety fuse is the powder train, and unless it is in good condition, results are likely to be bad. The worst fault that fuse can have is to be without powder. High-grade automatic machinery is used for detecting lack of powder or serious reduction in quantity, and it is a rare occurrence to find fuse lacking the standard charge.

There are two kinds of powder core. One is called "free" and the other "solid." "Free core" is where the grains are free in the yarns that inclose them and should appear clean and distinct. The "solid core" is where the powder core is made into a semisolid mass, clinging to the center thread and adjacent yarns, so that when the fuse is opened the powder will not drop out freely as it does in "free-core" fuse.

In examining fuse to see whether the powder core is injured, it is necessary to give consideration to the next most important feature of a good fuse, namely, the waterproof covering. These coverings are made of compounds of asphaltum, tar, etc., as well as gutta-percha. If improper materials are used, the compounds may penetrate through the yarns to the powder, and this will give it a dingy and somewhat sticky appearance, and may be so bad as to ruin it. Powder that is wet will be soft and dingy black in color, but usually it will harden into grayish lump particles after it has been dried. When the moisture has entered from the outside, the white exterior color is usually left in a lusterless, chalky condition.

Fuse may become injured in transit, storage or handling, and it is important that it be stored in a cool, dry place. Fuse stored in too warm a place is liable to be affected by the melting of the waterproofing materials and their penetration to the powder. Fuse should be warmed to a temperature from 60° F. to 70° F. before uncoiling, because in cold weather the waterproof material becomes brittle and will crack unless the fuse is carefully handled. Moisture kills the powder, and even

*From the "Du Pont Magazine."

when insufficient actually to kill it, its presence retards the burning speed. While the waterproofing covering may protect the interior of the coils, the ends absorb sufficient dampness to kill the powder, or at least make it difficult to light.

When fuse is so stiff and brittle as to break open in being handled, its water-resisting qualities are impaired. If fuse is allowed to become too old before it is used, there is danger that the varnishes will be dry and hard or that the powder may have become impaired by age, although such results are not likely to occur for several months if the fuse is properly stored. Gutta-percha fuses are the most subject to deterioration for the reason that gutta-percha, rubber and other vegetable matter of this nature are subject to oxidation from contact with air.

The uniformity of burning speed is a desirable quality, but fuse that burns in the open air with a maximum variation of 10% up or down from standard is within reasonable limits. The generally accepted standard is 90 sec. per yd., or 25 min. per 50 ft. This is fast enough to preserve a fair degree of regularity and slow enough to produce quiet burning.

The exterior appearance of the fuse has become of considerable importance. If the fuse is of extremely dingy appearance, it may be most excellent in quality, while on the other hand the reverse has been proved. Some kinds of waterproofing will absorb the white material put on the outside when subjected to the heat of summer, causing it to appear black or of a dingy yellow color. Either bad storage or transportation conditions, particularly too much heat, turn the outside of the fuse dark. This gives it an unfavorable appearance, but a test should be made and this will easily determine its condition.

An absent center thread will not alter the burning speed of fuse. Its purpose is merely to make certain the powder flow in the fuse machine, and if the powder is present in proper quantities the center thread is unnecessary. The size of the powder core does not in itself alter the burning speed. The properties of the powder and the mechanical and constructional effects employed govern this.

In tape fuse, places may be found where the diameter is slightly enlarged for about an inch in length. These are caused by the overlapping of the ends of the tape where two pieces are sewed together to make a continuous length. They are perfectly harmless.

Cut off about 2 in. from each end of the coil before using to be sure that the ends are dry, as the powder may have absorbed moisture from the air. For this same reason it is unwise to cut up the fuse lengths much ahead of actual need unless they are stored in a dry place. Cut off the ends of the fuse squarely, especially where they are to be inserted in a blasting cap. One cut diagonally is apt to fold over and interfere with the spit. For wet holes, the joint of the cap should be made waterproof by an application of P. &. B. paint, heavy axle grease[1] or Kapseal.

In tamping use a wooden tamping bar and a stemming material that is free from sharp bits of rock or anything that will cut the fuse. Be careful not to kink or double it over in the holes.

[1]The Coast Manufacturing and Supply Co., manufacturer of much of the fuse that is used in the Butte mines, has published a pamphlet which contains the following: "Grease and oil, being solvents of the fuse varnishes, destroy the powder train in the fuse with as great, if not greater, rapidity than would the water which the miner is trying to exclude."—Editor.

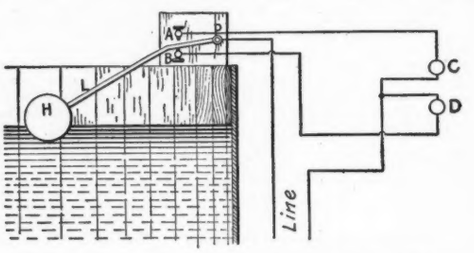
The kind of stemming material used is important because considerable gas is generated by burning fuse, and if it is too closely confined by a material that is not porous, the pressure of the gases rises to such an extent that the speed of burning is much affected. Usually the speed is increased as the pressure rises. In experiments made of moist fireclay as a stemming material, the rate of burning of the fuse was increased over 50%; but with dry sand, moist sand, and dry fireclay, the increase in the burning rate was comparatively small.

Signal for Water-Supply Tank*

Now that cold weather is once more with us every power-house engineer who has to look after a water tank placed on a hill to supply water to the town knows how unpleasant it is to go out of a warm engine room to find out how much water he has in the tank. Many such engineers let the pump run most of the time at full speed, in which case it generally happens that the tank overflows.

This is a waste of power, for at a small cost a signal system may be installed that would take care of the water-supply. Such a system is shown in the accompanying sketch. It is designed to work on either a 110- or 220-volt circuit; however, should only 550 volts be available, two 250-volt lamps in series at *C* and two at *D* would be all the changes necessary. *H* is a hollow ball, which may be made of copper or of cork.

This ball is fastened at the end of level *L*, which is pivoted at *P*, its rise or fall completing the circuit of *C*



SIGNAL FOR WATER-SUPPLY TANK

and *D*. If rising, *L* makes contact with the adjustable screw *A* and will light lamp *C*; if falling, it makes contact with *B* and lights the lamp *B*. The latter lamp should be red. A means must be provided so that any undue rise will not bend the lever. This may be accomplished by using contact springs instead of contact screws. It might be well to solder a small piece of silver at the contact points *A* and *B*. Lights *C* and *D* should be so placed in the engine room that the engineer's attention will be readily drawn to them.

Should no current be available, the signal could be arranged to work with bells, by placing 4 or 5 dry-cells across the lines, with a small bell at *C* and another at *D*. Of course the ring of these bells should have different sounds so that the engineer will know whether the water is high or low, thus indicating to him whether he should slow down or speed up the pump.

Cages for Hoisting Men—No operator of any mine should permit the hoisting or lowering of men through a vertical shaft deeper than 300 ft. unless an iron-bonneted safety cage be used, except during the process of sinking.

*C. F. Fuetter in "Coal Age," Nov. 13, 1915.

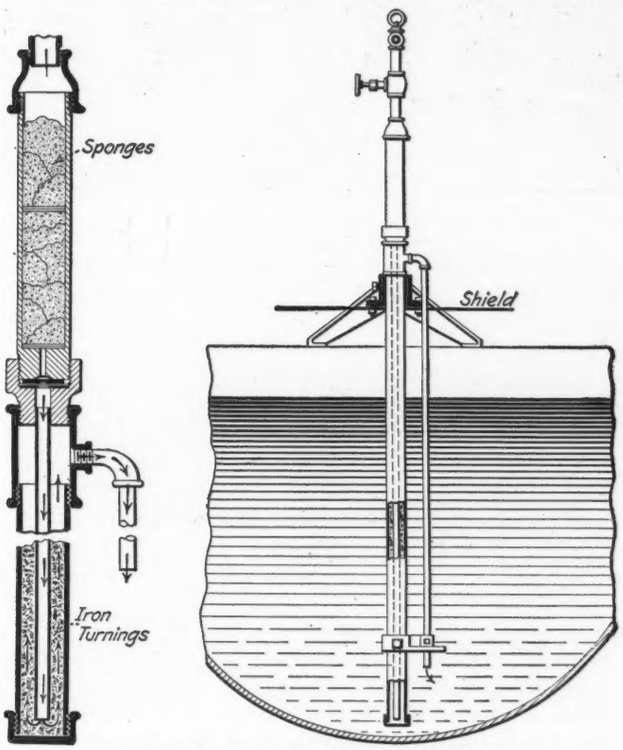
Details of Milling and Smelting

Bardill Drossing Apparatus

By J. O. Bardill*

The sketches accompanying this description illustrate a device for agitating the molten lead in the drossing kettles in the refinery of the St. Joseph Lead Co.'s smelting plant at Herculaneum, Mo. It has been in use there for the past four or five years.

When the archaic method of using "a green pole of ze fir (or willow) tree zat shall be perfectly dry," etc., was discarded, live steam from the boiler plant was substituted. It was conducted through a pipe line about



THE BARDILL DROSSING DEVICE

600 ft. long, weirdly devious in its course, besides possessing other features that make for general inefficiency and grief in operation.

This new device operates on the flash-boiler principle. The flow of water entering the generating chamber is fixed by an aperture about 0.020 in. in diameter in a diaphragm which separates it from a filtering compartment. The heat of course is derived from the molten lead. The filtering compartment is filled with a very cheap grade of sponges, with several thicknesses of copper-wire gauze placed above the diaphragm.

The iron lathe turnings in the generating chamber, for increasing the heating surface, were found to be unnecessary. The circular shield that is usually attached to the generator barrel at a point above the top of the kettle is also unnecessary. As the cost of these devices is low, an extra one is always kept in readiness for use in case the diaphragm's opening should become clogged.

Facilities for handling these agitators consist of a small chain block and trolley operating on the same I-beam track used in making kettle replacements. After submerging the generator, the filter compartment is connected to the water main by means of hose and coupling. This device is proof against accidents from blow-ups such as frequently occur through entering water when steam is obtained from some outside source. It is not so mussy, since there is no condensation to take care of as when the old system of steam is used.

Compared with compressed air, as used in some plants, it is cheaper, particularly if a compressor must be installed and operated solely for this operation in refining.

*450 Lafayette Ave., Palmerton, Penn.

Steam-Jacketed Drying Table for Tailing Samples

The rapid drying of the considerable number of tailing samples taken daily at the mill of the Miami Copper Co. at Miami, Ariz., is effected by the simple steam-jacket table shown in the illustration.

The jacket has an internal steam space of about 3 in. and is 24 to 30 in. square. It is supplied with steam at 45 to 60-lb. pressure. The jacket is supported on

STEAM-JACKETED DRYING TABLE

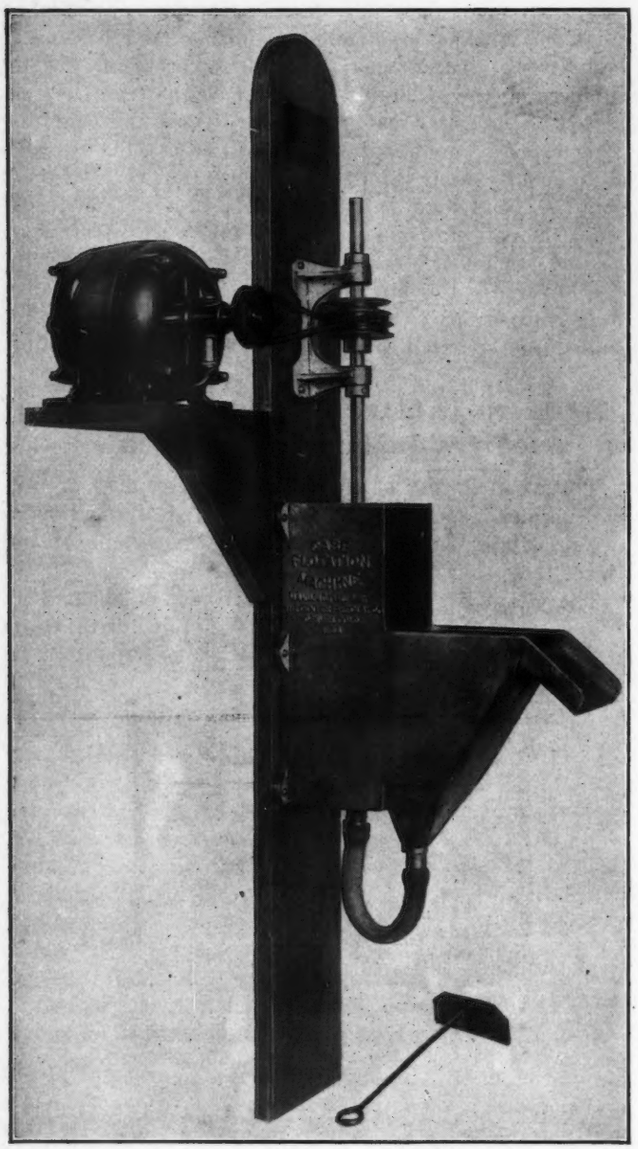
a stand of light 1-in. angle irons at a convenient height and slopes at a low angle to the back. Around two sides and across the back, there is riveted a steel edge that stands about 4 to 5 in. high at the back of the table, sloping to about 2½ in. at the front of the sides.

The tub of tailing sample is held on the edge of the table and all the sample is washed on the jacket by a stream from a hose with a small-diameter nozzle but with water at high pressure. The greater part of the water evaporates immediately upon striking the table, the temperature of the plate being considerably above the boiling point. In a few minutes all water is evaporated, and by the time the operator has loaded the sixth table the sample on the first is dry and ready to be removed. The rapid drying is extremely convenient for handling tailings, but probably the temperature would be too high to dry concentrated fine sulphides safely.

Laboratory Flotation Machine

To meet the demand for a simple and efficient machine for making flotation tests, the device illustrated here has been produced by the Denver Fire Clay Co., of Denver, Colo. The machine may be installed on any wall or post and is ready for immediate use.

The main, or cell, portion of the machine is made of cast aluminum, as is also the impeller. A feature introduced is the closed-circuit arrangement by means of a short length of high-pressure rubber hose, it being thereby possible to attain the same repetition in treatment as is otherwise accomplished in a multiple-cell machine. When this circuiting is not desired, a simple pinch-cock is applied to the hose.



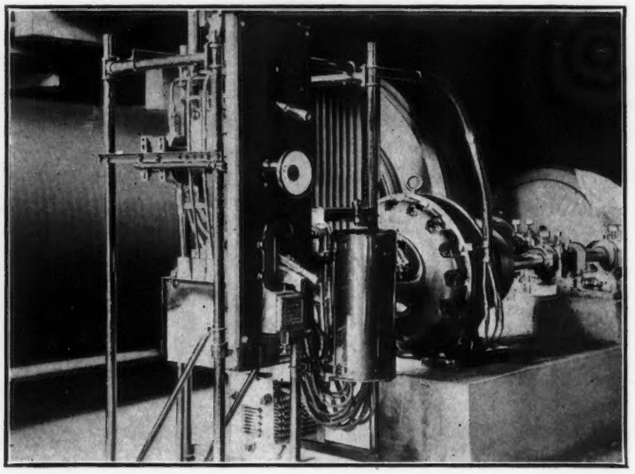
FLOTATION MACHINE FOR THE LABORATORY

The motor is rated at ⅛ hp., has variable speed up to 1,800 r.p.m., is reversible and may be supplied for any electrical specification. The impeller shaft runs in bronze bearings and is provided with collars permitting the adjustment of the impeller to run at any desired depth in the agitation compartment.

Unit Tube-Mill Control

The tube mill illustrated is one of the regrinders used by the Homestake Mining Co., at Lead, S. D., and is one of the exceptional installations having individual motor and control.

At the top of the panel is the regular switch and just below it, an induction-type ammeter. At the bottom is an electromagnetic blowout switch. At the right is a controller of the street-car type, somewhat unusual in milling plants. The entire installation is of Westinghouse manufacture.



TUBE-MILL CONTROL AT HOMESTAKE MILL

New Zirconia-Carborundum Refractory Material

A new material said to be highly refractory has been patented by August Pfaff, of Freiberg, Germany (U. S. Pat. 1,159,264), consisting of a mixture of zirconia and silicon carbide, or carborundum.

This mixture has the advantage over zirconia in that it is not subject to cracking during alterations of temperature, nor does it become brittle and lose its mechanical coherence, while it withstands oxidation by air where the silicon carbide does not. If it is desired to obtain the maximum of refractoriness, the silicon carbide should be employed in the form of a powder coarser in grain than the zirconia.

The highly refractory qualities of the new material make it adapted for the manufacture of electric resistances for use in cases where it is imperative that the resistances shall be efficacious at high temperature. The material is molded into the form desired and then burned before using. A considerable shrinkage must be counted on in the burning operation.

Melting Aluminum Chips

H. W. Gillett, at the American Institute of Metals meeting, emphasized the great improvement in aluminum recovery in melting aluminum chips, if the chips were mechanically clean. As fluxes, zinc chloride, ammonium chloride or a mixture of salt and fluorspar is recommended. A reducing atmosphere helps, but the great difficulty is not oxidation but prevention of coalescence by the dirt mixed with the metal.

Mining & Metallurgical Machinery

The "Little Tugger" Hoist

A new type of hoist has been placed on the market by the Ingersoll-Rand Co., New York City. It is intended for light lifting and has a capacity up to half a ton. Owing to its light weight, which is under 300 lb. complete, it is particularly suitable for use as a portable hoist for mines, contract work and power houses.

The main base of the hoist is arranged so that it can be bolted to a timber, and by means of a cap that comes

"LITTLE TUGGER" HOIST PULLING CAR IN TUNNEL

with the hoist, it can be clamped to a circular member, as a mine column or arm, shaft bar or pipe. The adjustment can be made quickly. Mines are using it in winzes, stopes and raises, clamped to a drill column or stretcher bar, shaft bar or timber, for various purposes. The dimensions of the hoist are 21¼x16½ in., and the height is 20⅛ in. The drum is 6 in. in diameter, with a space of 7 in. between flanges. This will accommodate a length of 700 ft. of ¼-in. rope or 450 ft. of $\frac{5}{16}$-in. rope. It operates with either compressed air or steam and has a capacity of 1,000 lb. at a rope speed of 85 ft. per min. and a pressure of 80 lb.

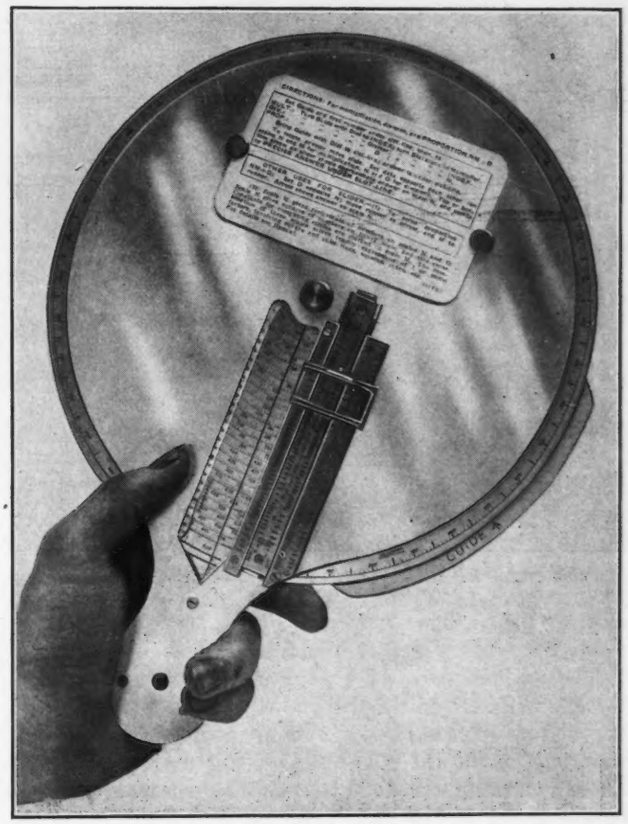
The motor, or engine, is of the reversible square piston type, giving four impulses per revolution of the engine. There are no dead centers and the "Little Tugger" will start in any position. Safety is provided for by a powerful worm-operated band brake lined with "Raybestos."

There are no moving parts exposed on the "Little Tugger" except the drum, all gears and shafts being covered.

Graduated-Spiral Slide-Rule

A slide-rule that may be directly read to four places and estimated to a fifth has been put on the market under the name of the Ross Precision Computer as an attempt to get the convenience of a slide-rule with the accuracy of a five-place logarithmic table. It is designed to be particularly useful for engineering computations and is the invention of Louis Ross, of San Francisco, who invented and now manufactures the "Meridiograph," described in the *Journal* of Aug. 1, 1914. The new device is manufactured by the Computer Manufacturing Co., 268 Market St., San Francisco.

The graduations are along a 29-ft. spiral on a disk about 8 in. in diameter, the upper members, 9 to 10, oc-



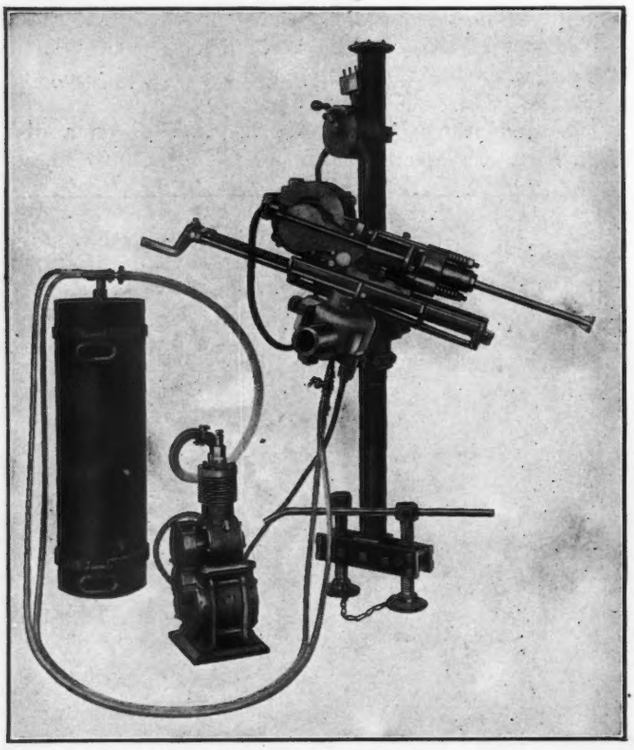
ROSS PRECISION COMPUTER—A SLIDE-RULE WITH GRADUATION ON A SPIRAL

cupying the outer portion of the scale. As a consequence the spacing is spread out by the increasing length of the spires, so that the 29-ft. scale is the equivalent of a 100-ft. rule. So great is this effect, that if the ruling were reversed, the scale would be equivalent only to a 16-in. rule. The outside ring of graduations is used in connection

with the quadrant scale to give five-place logarithms and antilogarithms for solving powers, roots and exponential problems. The operations of multiplication and division are as simply performed as with any logarithmic scale. The auxiliary 4-in. slide-rule on the face gives logarithmic numbers on the left-hand fixed scale and corresponding square and cube roots on the right-hand fixed scale. On the slide between are two logarithmic scales, both corresponding to the left-hand fixed scale but graduated in reverse directions. The computer is made of aluminum and german silver.

Denver Electric Rock Drill

An electric rock drill has been placed on the market by the Denver Rock Drill Manufacturing Co., Denver, Colo., in which it is claimed there are embodied some entirely new principles, which it is hoped will obviate the structural deficiencies and difficulties that have made mining men skeptical heretofore as to the benefits of the



DENVER ELECTRIC ROCK-DRILL OUTFIT

electric drill. This new device has been tried out by more than two years of practical service in mining.

The machine is a self-contained, direct-connected motor and cylinder unit and includes a small auxiliary electric-driven air compressor and an ordinary water tank, the function of the compressor being merely to supply air for cleaning the drill hole and to maintain pressure on the water in the tank used for drilling.

These drills require three-phase 60-cycle current, which may be used at 110, 220 or 440 volts, and transformers must be provided accordingly. The rotor shaft runs in ball bearings. Power is transmitted to the drilling mechanism by an internal reduction gear.

There are two cylinders in the main part of the drill. One contains a piston called the pulsator, mechanically reciprocated by the gears and a connecting-rod. Air is compressed in both ends of this cylinder and intermittently passed through end ports to the hammer cylinder (alongside) where it causes the hammer (not mechanically connected to any other part) to oscillate in step with the pulsator, striking about 1,200 blows per min.

On the outer side of the pulsator cylinder is a bypass device, by which the air in the pulsator cylinder is shunted from the hammer cylinder and caused to pass back and forth to opposite sides of the same cylinder. By this means the hammer may be stopped instantly or its blow may be adjusted to any degree without shutting off the electric current or interrupting any other function of the machine.

Rotation of the drill steel is effected positively by a ratchet and slip friction gearing. The steel will continue turning if the hammer be stopped by the bypass, and the machine as a whole may then be used as a boring tool. The loss of a hole by "fitchering" is rendered practically impossible. The drill steel is round and hollow, and a portion of the shank about 1 in. long is forged square.

The feed is by means of the usual screw and shell. The switch is so made as to render the drill runner safe against electric shocks.

Among the advantages claimed by the manufacturers for this machine are: Small power consumption, drilling speed, freedom from fitchering, lack of freezing trouble and low original cost.

Wiegand Chain Screen Door

A decided metallurgical novelty seems to be contained in the Wiegand chain screen door manufactured by the E. J. Codd Co., of 700-708 South Caroline St., Balti-

WIEGAND CHAIN SCREEN DOOR

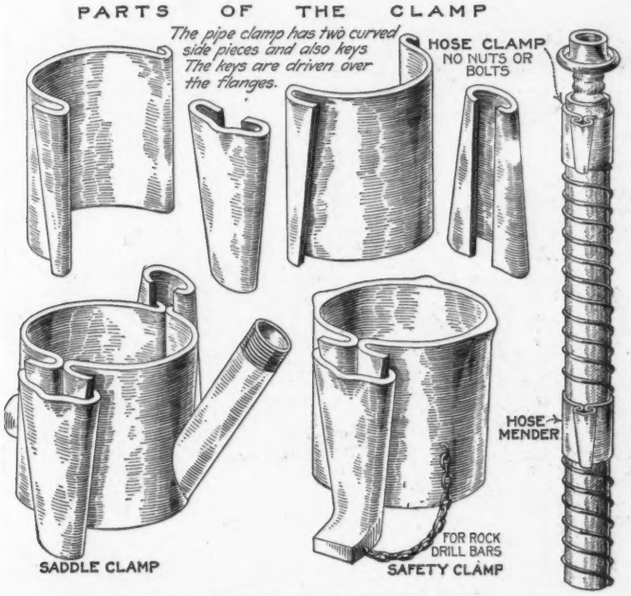
more, Md. This door consists of a number of freely suspended individual strands of steel chains, which form a curtain not unlike the familiar Japanese screen.

This screen to a great degree protects the workmen from the rush of hot air and furnace gases and from the glare of the interior of the furnace when the door is open. It also prevents undue chilling of the furnace by an inrush of cold air. Yet it can be seen through and can readily be pushed aside to introduce tools. So far this device has been chiefly used in connection with glass

furnaces and glass pots, and boiler furnaces, but there seems to be no reason why there is not a wide adaptability to refining and reverberatory smelting furnaces.

Underground Pipe Fittings

Such fittings as are shown in the accompanying illustration have proven economical and useful in the Rand mines. They facilitate repairs with speed and safety

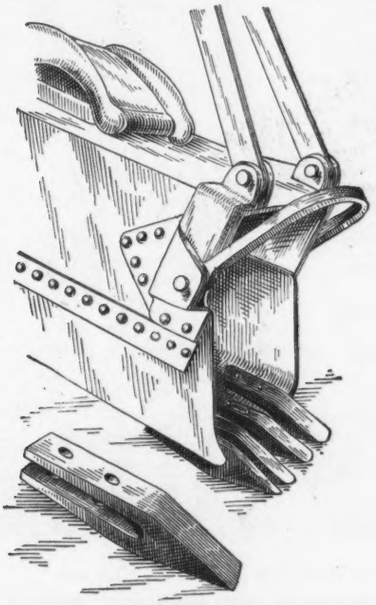

PARTS OF THE CLAMP
The pipe clamp has two curved side pieces and also keys. The keys are driven over the flanges.
HOSE CLAMP
NO NUTS OR BOLTS
HOSE MENDER
FOR ROCK DRILL BARS
SADDLE CLAMP
SAFETY CLAMP

SIMPLE CLAMPS FOR UNDERGROUND USE

on water and air pipes and air hose. They are known in South Africa as the Ussher fittings and are patented there.

Easy-Loading Dipper Tooth

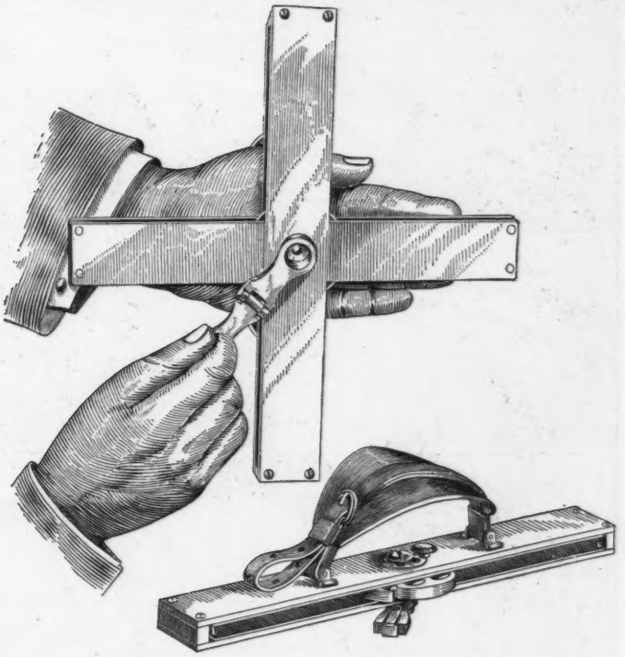
An easy-loading style of one-piece tooth for steam-shovel and dredge buckets has been designed and is being manufactured by George P. Chambers, 110 North Madison Ave., La Grange, Ill. The device is shown in the accompanying sketch. The tooth is made of carbon steel for resharpening or manganese steel for especially severe service. The teeth are reversible, so that when worn on one side they may be turned over and re-used. It is claimed that a bucket equipped with these teeth loads more material than with any standard tooth, and that particular benefit has been shown in picking up large stones on level ground. These teeth are used at several quarries in Illinois.



CHAMBERS REVERSIBLE DIPPER TOOTH

New Reel for Flat Wire Tape

A new four-arm folding reel has been put on the market by the Keuffel & Esser Co., of New York. When using tapes over 100 ft. long, it is customary to use the tape without a reel, the latter being carried separately. This is generally inconvenient, especially if the reel is bulky.



FOLDING REEL FOR 100-FT. TAPE

The present device has therefore been designd to obviate this advantage.

When the tape is off, the crosspiece can be folded into the frame and the reel, now a single flat piece, can be conveniently carried in the pocket, so that it is immediately available when the tape is ready to be wound up again. The frame is made of nickel-plated steel, in three sizes, holding ¼-in. steel tape from 100 to 500 ft. long.

Globe Patent-Lock Roofing

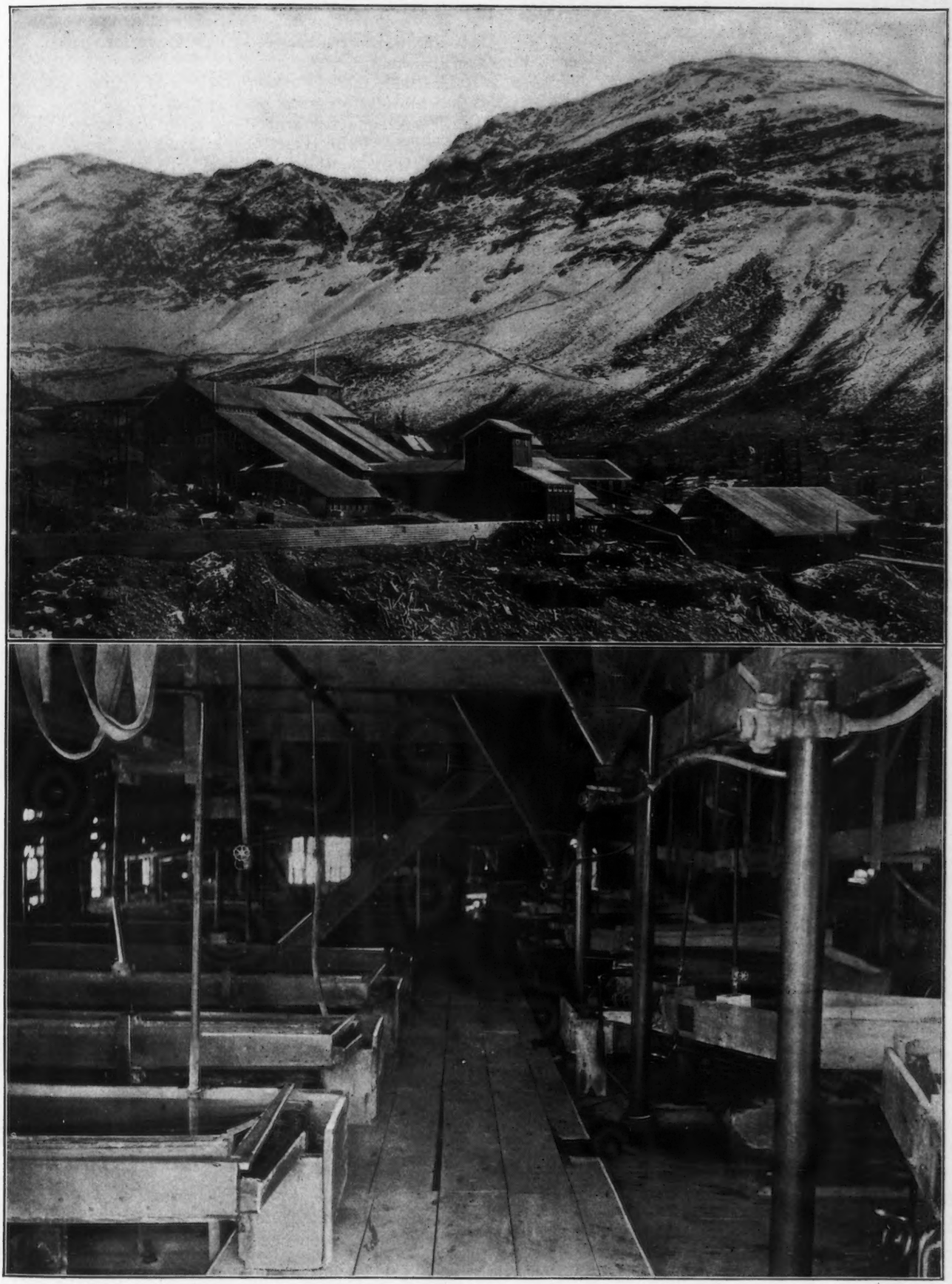
A new kind of lock roofing is being offered by the Globe Iron Roofing and Corrugating Co., of Cincinnati. The novelty is in the lap lock, which is so designed that the joint can be promptly and easily made, and will stay waterproof. The roofing may be had in plain or corrugated sheets or in the shingle-cluster form.

The Denver Engineering Works Co., of Denver, Colo., has published a bulletin (No. 1076) on ball mills, in which some interesting data are given. The special feature of these mills is the tire-and-roller type of bearing at the discharge end, permitting the use of a large discharge opening. This removes the necessity for screens, diaphragms, etc., and makes a simpler machine. The discharge opening is fitted with the Neal reverse spiral to permit escape of the balls.

Photographs from the Field

TWO VIEWS OF DIAMOND-MINING OPERATIONS ON THE SOUTH AFRICAN FIELDS

The upper illustration gives a general view of haulage operations. Cars of diamond-bearing ground are taken from the opencuts by a rope-haulage system, a continuous stream being carried to the dumping point and returned to the cut on a lower level. The lower illustration is a general viewof the washing plant.



EXTERIOR AND INTERIOR OF THE TOMBOY MILL, NEAR TELLURIDE, COLO.

Pulmonary Disease Among Miners

That the inhalation of sharp particles of dust injures the mucous membrane of the lungs and in this way lessens the resistance of the lungs to pathogenic germs, especially the bacilli of pulmonary tuberculosis, has been proved by investigations of morbidity among workmen in dusty trades and by study of the prevalence of lung diseases in South Africa and other foreign countries. The matter is one of deep public concern, and attention has been called to it from time to time.

Recently, with a view to affording some measure of relief through suggested educational work and through state legislation, the Bureau of Mines has undertaken, in coöperation with the Bureau of the Public Health Service, preliminary investigations of the production of dust in metal mines in various parts of the United States and the relation of the prevalence of dust to silicosis, or miner's consumption, and pulmonary tuberculosis among miners. Passed Assistant Surgeon A. J. Lanza, detailed to the Bureau of Mines, and Edwin Higgins, a mining engineer of the bureau, coöperated in making a survey of conditions in various metal-mining districts of the United States and made a report[1] dealing with the prevalence of tuberculosis among the miners of the Joplin district, Missouri. The following summary of conclusions and recommendations was made:

Summary of Conclusions Arrived At

1. The death rate from pulmonary diseases is unusually high among the miners of the Joplin district.

2. Poor housing, exposure, alcoholism, the use of common drinking receptacles and overwork, all tend to spread infection and lessen the power of the miner to resist disease, but the prime factor in causing pulmonary trouble is the rock dust in the mines.

3 Rock dust in the sheet-ground mines, although not made in great quantity as compared to mines with more restricted working places, is harmful to the miner for two reasons—because he is exposed to it practically during his entire shift, and because the dust is made up chiefly of particles of insoluble flinty chert with splintered and knifelike edges.

4. This rock dust is produced by the blowing of dry holes, squibbing, boulder popping, drilling without water, shoveling, tramming, roof and pillar trimming, and the dumping of the bucket at the surface.

5. By observing certain precautions rock dust in the mines can be almost completely abated.

6. There are certain abuses connected with the piece system of work that demand attention and correction as far as practicable.

Recommendations for Allaying Rock Dust

1. The following means should be employed for the abatement of rock dust in the mines:

a. Provide a water-supply for every working face by the laying of a separate water line.

b. Where drills are operated without water, attach to the hose leading to the face a 5- or 6-ft. length of pipe with a nozzle from ⅛ to ¼ in. in diameter. Make and enforce such regulations as will insure the use of this water spray for the purpose of wetting drill holes, the face, and the broken rock about the face. For the purpose of washing drill cuttings from drill holes, this hose may be attached to the long pipes now in use for blowing-out drill holes.

c. Where there is in use some type of drilling machine that provides for water passing through the core of the drill steel into the drill holes, make and enforce regulations that will insure the spraying of the face and broken rock for short periods at such times as the drill may not be in operation. For this purpose the water hose must be uncoupled from the drilling machine unless separate water connection is provided.

d. Make and strictly enforce rules against squibbing and boulder popping while the shift is underground and against the blowing of dry holes at all times.

e. Improve ventilation by the opening of new shafts whenever practicable.

2. Do away with common drinking cups and kegs, and water pipes that allow the miner to bring his lips in contact with the orifice. Substitute the well-known sanitary drinking fountain when practicable, or have miners bring their own drinking water in individual containers.

3. Do not employ as shovelers men under 20 years of age.

4. Through coöperation among the operators, stipulate a maximum daily tonnage for shovelers, so that they cannot injure their health through overwork.

5. Provide a warm, dry and clean place in which the miners may change their clothes.

6. Through intensive educational campaigns in the public schools and among the miners themselves, disseminate information as to the harmful effects of insanitary practices and conditions, such as crowded living quarters, overwork, exposure, dissipation, the breathing of air polluted by powder fumes and rock dust, and the use of common drinking devices.

[1]Technical Paper 105, Bureau of Mines.

A One-Leg Ore Trestle

Brainerd Correspondence

A new ore trestle just completed at the Wilcox mine, Woodrow, Minn., presents some features novel, at least, to Cuyuna Range operators. It is of the one-leg type, the legs being 6-in. wrought-iron pipe 36 ft. long set in concrete foundations and themselves filled with cement. A flange coupling at top and bottom permits connection with foundation and crosscaps. The legs are then guyed with ⅝-in. cable.

This constitutes the permanent trestle, beyond which are two bents of wooden-post trestle, where the ore is dumped. End-dump cars are used until the ore pile is of sufficient length, when side-dump cars will be used to make additions alongside.

Such arrangement leaves a stockpile free from timbers to interfere with steam-shovel loading.

More Dredges in Colombia

The Anglo-Colombian Development Co., which is operating in the gold-platinum region in the western part of Colombia, contemplates the installation of more dredges on the Condoto River. At the recent annual meeting in London of the Consolidated Gold Fields of South Africa, Lord Harris stated that the dredge which has been in operation since July had obtained results

that fully justified considering ways and means of producing gold and platinum on a larger scale by the provision of more dredges. An engineer has been sent to Colombia to investigate the conditions affecting the development of power for additional dredges and an enlarged scale of operation.

Besides this prospective increase, mention has previously been made of the program of construction contemplated by the Oroville Dredging Co.'s subsidiaries in the Nechí Valley in central Colombia.

The Deepest Gold Mine, Morro Velho

The deepest gold mine in the world—the deepest mine of any kind, it is believed—is the Morro Velho in Brazil, owned by the St. John del Rey Mining Co. Some particulars about it are given in the annual report lately published in London.

For the past three years the lowest developed horizon has been the 18th, at a 4,900-ft. depth from adit level, equal to 5,226 ft. from surface. For the purpose of attacking ore at greater depth shaft G has been sunk from the end of a tunnel at the 16th horizon, and from this shaft horizons 19 and 20, respectively 5,202 and 5,502 ft. below adit level, have been commenced. The 19th horizon is expected to be developed and ready for raising ore by June next, and the 20th horizon by April, 1917. The opening up of these two new levels is expected to add something like 600,000 tons to the ore supply, and it is believed that values will be maintained.

If the mine could be worked down to the 20th horizon only, it might be assumed that its life would not be longer than about six years. However, there is no intention to stop work at the depth attained by the 20th horizon. The superintendent's last annual report deals very exhaustively with this subject. He says, in effect, that except for the rapidly increasing temperature of the mine, supposing the lode continued the same size and value to horizon 26 (vertical depth 7,626 ft.), it could be worked profitably to that point and even to a greater depth, but from the temperature chart the rock at horizon 26 would be no less than 126.5° F. at the moment of opening. It is not believed that much more can be done in present circumstances in the matter of increasing the volume of ventilating air, but the opinion is advanced that by artificially cooling the air passed down the mine the difficulty can be overcome and the mine worked to considerably greater depths than yet reached. An air-cooling and drying plant has been designed which, it is stated, "represents a thoroughly practicable scheme that will effectually remove the one serious obstacle against the company being able to work the mine to a great depth."

Molybdenum and Tungsten in Chile

A report from United States Consul J. W. Voetter at Antofagasta, Chile, mentions recent reports that at the mining community of Campanany, in the Province of Tacna, Chile, there exist considerable deposits of molybdenum and wolfram, in addition to copper sulphides. While the mines have not been developed, samples of the ores have been sent to Europe for the purpose of finding a market for the minerals. The address of the president of the mining community is Sr. Jorge Romussi, Iquique, Chile.

Newspaper reports also state that a good vein of wolfram has been discovered in the property of the Cia. Estañifera del Llallagua, at Llallagua, Bolivia. The principal office of this company is at Santiago, Chile.

Lake Superior Iron Outlook

ISHPEMING CORRESPONDENCE

Navigation will be about at an end within a few days, and the mining companies and boat companies are already making their plans for 1916. Never in the history of the iron-ore business has there been such optimism as one hears in the Lake Superior district today. The question is not how much ore can be mined, but how much the lake fleet will be able to transport to lower lake ports. It has been estimated that 55,000,000 tons will go down next year, but other opinion doubts that the boats will be able to handle any such tonnage. However, it is probable that the record of 50,000,000 tons, made in 1913, will be surpassed. There has been an advance of 10c. a ton for carrying ore next year, and a large number of the boats have already been chartered. The Steel Corporation entered the field first and chartered a great deal of tonnage, in addition to its own fleet operated by the Pittsburgh Steamship Co.

Just what prices will be received for iron ore in 1916 it is impossible to forecast now. A dollar advance is predicted, while 50c. advance seems certain.[1] The operators are making preparations to get out a maximum tonnage, and nearly all of the underground mines in the Lake Superior district will be worked this winter. New mines are being developed and opened. The Arthur Mining Co., which took over the Hill properties on the Mesabi, is ordering equipment and doing a lot of stripping. The same is true of other Mesabi concerns. Oglebay, Norton & Co. are to put the Meteor shaft, on the Gogebic range, down so that the ore can be tapped. The Hanousack, on the same range, is to be stripped; Butler Bros. have the contract. The Cleveland Cliffs Iron Co. is to sink a shaft and mine ore on what is known as the Junction Forty, on the Marquette Range. Corrigan, McKinney & Co. are to sink on the Adgers lands on the Menominee range.

The concerns that furnish machinery for the mines of the district are flooded with orders. Rock drills, compressors, hoists, steel, etc., are badly needed. The companies have kept their purchases at a minimum during the dull times, but now that they know that they are going to be able to sell all they mine, and at better prices, they want the necessary tools.

It is feared that there may be shortage of labor next season. Many foreigners have gone from the Minnesota ranges to Europe during the past year, and many miners have left the district for other camps when things were dull on the iron ranges, being attracted by the high wages being paid to copper miners in Butte, Bisbee and other Western copper camps. There will probably be plenty of common labor for surface work and work in the pits, but a scarcity of first-rate underground men would not be surprising.

[1]According to telegraphic reports of Dec. 8, the advance is about 75c.—Editor.

Lake Superior optimistic operators expect 1916 to be a big year in the iron ore business, but 1917 and 1918 to be still bigger.

Chronology of Mining for November, 1915

Nov. 1—Canadian Copper Co. adopted eight-hour day for all men at smeltery and shop, and granted increase to men in mines working on an hourly rate.—Gaylord mill, Cripple Creek, burned to the ground.

Nov. 2—Strike at Thetford mines, Quebec, settled.

Nov. 5—Concentrator of Arizona Copper Co., Clifton, Ariz., destroyed by fire.

Nov. 6—Strike at Nichols copper refinery.—Ray-Jefferson stockholders voted to increase capital stock from 1,500,000 shares to 2,000,000, par value, 25c.

Nov. 9—Strike at Silver King Coalition mine settled.

Nov. 10—Alice mine, Butte, reverted to Anaconda company, no offers having been made when offered at public sale.

Nov. 11—Mill of National Copper Co., Idaho, started operation.

Nov. 14—Law enacted in Peru levying export duty on gold, silver, lead, copper and other metals, and on borax and petroleum.

Nov. 16—Commencement of suit between Alameda Mining Co. and Success Mining Co.—Strike at Nichols refinery settled.—Explosion in mine of Northwestern Improvement Co., at Ravensdale, Wash.; 34 men entombed, of whom three were rescued.

Nov. 17—Announcement of Kennecott-Braden consolidation.

Nov. 22—Federal investigation of Clifton strike begun.—Villa reported driven out of Cananea.

Manganese Developments in Virginia

ROANOKE CORRESPONDENCE

The actual results, so far, accruing from the renewed interest in the managanese deposits of Virginia, due to the war market for the ore, have not been so satisfactory as was hoped for a year ago. There have been a great deal of negotiating and several attempts at financing, and engineers, ore buyers and investors have worn quite bare the trails in the best known manganese-bearing areas.

The Crimora mines properties at Elkton, one in Rye valley and several others have, however, received serious attention, and with good results as far as development has progressed. The Piedmont Manganese Co.'s mine, near Lynchburg, has been reopened and promises soon to resume shipments. At Crimora the consummation of the very extensive equipment and financial program has delayed actual output. At Elkton litigation as to title has kept back recent negotiations. In Rye valley, financial mishaps in Philadelphia postponed the completion of what promised to be a successful operation to mine manganese and manganiferous iron ore. Numerous smaller operations have realized small shipments. On the whole, outside capital has not yet come to take the Virginia deposits very seriously, and local capital is not available ordinarily for even the prospecting of the many promising deposits in the Piedmont, James-Staunton River, and the southwest Virginia districts.

United States Motor Trucks for Bolivian Tin Mines

SPECIAL CORRESPONDENCE

Alexander Grosberg, of the Patiño tin mines, recently left St. Louis for Uncia, Bolivia, where the mills and mines of the company are situated. While in the United States Mr. Grosberg arranged for the construction and purchase of a large number of motor trucks to be used in transporting tin and concentrates from the mills to the railroad. The transportation problems there are unusual, and the introduction of motor trucks of American make is of great importance to manufacturers in the United States.

The contract for transporting the concentrates of the great tin mines of the Llallagua and Patiño companies is now held by a single transporting company. The distance from the mills to the railroad is about 60 mi., the average grade 4½% and the maximum grade 15%. During eight or nine months the roads are good, but during three or four months of the rainy season the constant and heavy traffic makes the roads almost impassable. During the dry portion of the year six mules are used on each cart carrying 8,000 lb. of ore, with an addition of six more mules at the worst grades. During the wet season six mules are used for each cart carrying 4,000 lb. of ore, with an addition of 12 mules at the points of worst grade. The contract specifies that all concentrates produced during a given week must be delivered at the railroad by the end of the following week, heavy penalties being imposed when this part of the contract is not fulfilled.

It is now proposed to substitute motor trucks for this work. Trucks for this use must have special features, especially in connection with the cooling system and traction. For the latter a four-wheel tractor is proposed. The first order of trucks will be for about 30. If these are successful, it means that motors will supplant all other methods of transportation on the Oruro plateau, and that thousands of American-made cars will be required for this work.

It is evident that one of the best methods of securing South American trade is the education of American engineers for this field. Mr. Grosberg was graduated from the Missouri School of Mines in 1911.

Porphyry Copper Dividends

At the meetings of the porphyry copper companies held on Dec. 8 the following dividends, payable Dec. 31, were declared: Chino, $1 quarterly; Nevada Consolidated, 37½c. quarterly and 12½c. extra; Ray, 50c. quarterly; Utah, $1.50 quarterly. Butte & Superior declared a regular quarterly dividend of 75c. and $7.50 extra.

Phosphorite Deposits in Russia are being investigated under the direction of the Ministry of Agriculture. So far the only deposits found to be of any commercial value are those on the Upper Kama River. These, containing 27 to 28% of phosphoric acid, are worthy of consideration for both quality and quantity, as well as the fact that they are situated near the deposits of iron pyrites in the Ural Mountains.

Editorials

Carrie Everson

Ever since the flotation process established itself the name of Carrie Everson, the first patentee of a flotation process that bore the earmarks of experimentation, has been on the lips of all metallurgists. Many efforts to learn something about her have been made, all of them unsuccessful until recently, when some members of the Colorado Scientific Society traced her. Most of the searchers had previously come to the conclusion that probably she had died long before. Strange to say, she was living at that very time and had failed to make herself known during the excitement of patent litigation and the common talk about her. Unfortunately she died only about a year ago, but before anybody had been able to interrogate her about her invention.

According to the Denver *Times,* Carrie Everson was the wife of a Doctor Everson, a physician who had been practicing in Chicago. She was born in Sharon, Mass., in 1842, her maiden name being Carrie Jane Billings. Early in the '80s the Eversons moved to Denver on account of the doctor's health. He died a short time afterward. Everett A. Fay, a bookkeeper in the Denver National Bank, who knew the Eversons, is reported as saying that the discoverer of the flotation principle was Doctor Everson. After his death his widow pursued the idea, took out the patents, and for his aid in promoting the process let Criley, a Denver blacksmith, become associated with her. She continued her experimental work for several years. She lived in Denver until 1909, when she joined her son, John L. Everson, in San Anselmo, near San Francisco, where she died Nov. 3, 1914.

Members of the Colorado Scientific Society are now trying to get at the facts of the Eversons' discovery and will propose some fitting testimonial to them. The legend of the Denver spinster-schoolteacher washing the ore-sacks of her assayer-brother seems to have been destroyed. In this interesting history there stand out two things, namely, the quiet life of Mrs. Everson in the time when she had become an international figure, and the unanimity with which she is hailed by Americans as the real discover of the flotation process, although the owners of certain patents deny it.

The Situation in Copper

The little recession that has occurred in the price for copper during the last fortnight is devoid of any broad commercial significance. The users of copper have bought very liberally, and most of the producers have sold—at fine prices—their expected output for a length of time ahead that is far beyond their ordinary hopes. The users naturally cannot keep on buying indefinitely; on the other hand, producers when sold ahead so well as they are now are indifferent whether they do new business every day or not. Indeed, they do not expect to.

However, there are many small producers of crude copper, not in a position to enter into contracts for the delivery of refined, who need to sell their output right along in order to keep going. This copper is often to be had by traders and refiners on favorable terms, and against such purchases refined copper may be sold at only a slight advance. Persons trading thus in copper will sell it for what they can get, so long as there be any profit in the transaction. Consequently prices are apt to sag off in a narrow trading market, but when a large demand for copper develops again, the market is likely to rise to the terms of the big producers, if the statistical position be sound. If the statistical position be hollow, a sagging in prices after the culmination of a big advance is apt to foreshadow a pronounced downward trend, the big producers usually coming into the market again at a much lower level, after the old orders on their books have been exhausted. At the present time it is believed that the statistical position of copper and all of the fundamental conditions are of very strong character.

How the Metals Are Sold

The quantity of the principal metals—iron, copper, lead and zinc—that is sold to consumers out of warehouse, or "on the spot," is relatively insignificant. The bulk is sold on contracts for delivery during the ensuing two or three months, the buyer covering what he expects to use during that period and taking delivery more or less at the mutual convenience of himself and the seller. Thus he may request the seller to advance or delay the stipulated delivery, and in general the latter is glad to oblige his customer and does so if it be possible. In lead only does an essentially different method prevail. The principal producer of this metal has long maintained the custom of selling only for shipment within 30 days, although its competitors sell their lead just as other producers sell their copper and spelter. However, a very large part of all the lead used by consumers in the United States is sold to them on long-running contracts, settlements being made on the monthly quotational averages.

In making the usual contracts for copper and spelter there is ordinarily no discrimination as to prompt and futures—that is, within the ordinary deliveries in the trade—or if there be any, they are but trifling. At certain times when stocks have been reduced to a small figure—for example, in the case of copper in 1906-7—the belated buyer who had to have immediate delivery was obliged to pay a premium, but such of course was no more representative of the broad commodity market than the expenses of a belated traveler who has to hire a tugboat to put him aboard the steamship are a measure of the current fare to Europe. Lumped with the whole volume such premium business figured disappearingly small.

There is of course at all times some freakish business that partakes of the nature of a betting transaction. Thus, copper being at 15c., somebody may offer to buy at 13c.

a large quantity to be delivered during the next 12 months and may find somebody to take him up. In such a case the buyer may be covering his requirements for manufactured wares previously sold, while the seller may figure that the trend of copper is downward and that his sale would look good if the metal should happen to sink to 12c. or 11c. But transactions of this sort are unusual.

The uncertainties and extraordinary conditions produced by the war, however, have led to a great many transactions that are unusual. The most remarkable exhibitions of these have been in spelter. In this metal we witnessed first a practical disappearance of stocks, a loss that always deprives a market of its balance wheel. This was followed by the payment of large premiums for prompt delivery, while the ordinary two months' and three months' contracts could hardly be made at all. Then there was a wild rush for the metal and contracts covering six months or more were made, there being practically no limit to what buyers would do. At some times there would be a backwardation in price for future months, and at some times there would not be any to speak of. It was all a grand mix-up.

Recently there was a new feature, in that for a while there was scarcely any business for the quarter immediately ensuing, while rather a large business was transacted for delivery in the quarter next following. This produced a condition of spelter being sold at 13@14c. for one quarter and 10@11c. for the next. A pronouncement of what is the spelter market under such conditions was necessarily arbitrary. For the first quarter spelter was difficultly salable, but producers maintained a relatively high price. For the second quarter they were glad to take 3c. less, believing that when the time came the contract prices would look very high. On the other hand, there were buyers, chiefly foreign, who were willing to engage large tonnages at the figures named.

The copper business has at times exhibited irregularities, but none so erratic as in the case of spelter, for the copper market never lost its balance wheel of an available stock of the metal. At one time—in the height of the great selling movement of May-June—contracts for copper a very long way ahead were entered into, but these were at the prevailing price. Not long ago there was some maneuvering by producers to get some good contracts for distant deliveries on their books at the expense of apparently less advantageous sales of early supplies. However, abnormal transactions of all sorts are to be expected while the entire commercial machinery of the world is disarranged in the way it is and while speculation of all kinds is so rampant.

The Situation in Mexico

The warfare in Mexico appears to be all but over. Carranza and his followers have won. The victors are now trying to restore order in the land. This will be a matter of some time. There will no doubt be maraudings and guerrilla operations for many months, but gradually those should cease.

The big mining and metallurgical companies are taking active steps to resume operations. They report surprisingly little destruction of their properties. However, they are hampered, and will be for a while, by the destruction of railways and railway equipment. Probably they will be obliged to help the Government supply the latter, the Government having but little money of its own to spare. In other words, the larger companies, which must move freight, will no doubt buy locomotives and cars for the railways and accept reimbursement in the form of deductions from their freight bills.

Some private traders of more adventurous instinct than others are already going into Mexico. These early birds may reap large profits, but of course they will be exposed to great risks. We have been asked by numerous machinery manufacturers whether the time is yet ripe for them to send their travelers into Mexico to go after business. Great business is going to come to them from Mexico, but we think it is still premature to inaugurate regular measures for getting it. However, the time for them will come ere long.

Mine Taxation Problems

The enormous profits realized by some of the companies supplying military material were bound to attract the attention of the tax gatherers. Thus some persons in New Jersey are getting excited over the New Jersey Zinc Co., whose Franklin mine is assessed for taxation at a valuation of about $2,500,000, it is alleged, while the company pays annually many millions in excess of that sum as dividends. The system of taxation that prevails in New Jersey requires mines to be assessed at an absolute value, just like real estate, the New Jersey tax laws being similar to those of Michigan and a few other states.

An absolute valuation of the Franklin mine would be something of a job. Experts would be rather reluctant to undertake it. However, the inexpert are wont to rush in where the experts fear to tread. The ore of the Franklin mine is taken over into Pennsylvania for smelting, wherefore it is a puzzle to discriminate between mining profits and smelting profits, besides which there are some knotty problems in between. Moreover, the New Jersey Zinc Co. has extensive mining and smelting interests in many other states.

Prospects for the American Consulting Engineer

Note has previously been made in the *Journal* of how seriously the mining companies of Great Britain are being affected by the new taxes, which in certain cases are figured as taking two-thirds of the profits, when they are added to the older and local taxes. Obviously there exist but few mining companies that can stand such a burden, and it is only natural that some of them are considering the transferal of their headquarters to New York. Especially would such a transfer seem to be logical when the properties are situated in this country or in its neighbors to the north and south.

We may look also for a migration hither of Anglo-American and British engineers. If the mining companies come they will naturally have to come too. Another incentive will be the probability that American capitalists will soon begin to participate in foreign enterprises, especially in Russian, in which these men are experienced. There may be, indeed, a revival of the practice of consulting engineering, which for many years has been a dead profession in New York.

BY THE WAY

A geological map of Tennessee has just been issued by A. H. Purdue, state geologist of Tennessee. A copy may be had by sending 10c. in stamps to him at the State Capitol Annex, Nashville, Tenn.

Capt. Laurance Angel, U. S. A., according to the "Boston News Bureau," estimates taxable property in New York City at $10,000,000,000, of which amount at least $5,000,000,000 is subject to destruction by an enemy. He believes it is cheaper to insure this property by increasing the army and navy than to pay the ransom which a conqueror of the city would demand.

War and war conditions have had a disastrous effect on the diamond business. An evidence of this is found in the statement that during the first four months of 1915 only 64,977 carats of diamonds were exported from British South Africa, against 1,524,640 carats in the corresponding months of 1914 and 1,862,126 carats in 1913. Diamond mining in German Southeast Africa has ceased entirely for the present.

The first tube mill was introduced into the United States by J. R. Alsing in the late '70s. These machines were known at that time as "pulverizing cylinders," and those who imagine that the short tube mill is a modern development will be surprised to learn that the size of the early mills was 6x6 ft., according to our informant. The first pulverizing cylinder was made by the firm of Ball & Jewett and was installed in the Union Porcelain Works at Greenpoint, Brooklyn, where it was used for grinding pottery material such as feldspar and similar minerals. About 1880 some mills were built that were 6x8 ft. These were called "Jumbos" at this period. The pulverizing cylinders were soon introduced into the talc industry at Gouverneur, N. Y., but have not received such wide adoption in this industry as they have in metal mining, where the practice in some branches seems to be veering back to mills of practically the original proportions.

Miss Anna List, the famous syndicated lady psychologist, has at last completed her great life work—a delicately wrought analysis of Success, says *Judge*. For years the unsuccessful portion of humanity, comprising in all somewhat over 99% of the population of the globe, has waited impatiently for some authoritative information in regard to the chimerical composition of this irresistible force in business, political and religious circles.

SUCCESS

Honest work	1.027
Other work	25.878
Honest advertising	00.023
Ordinary advertising	17.101
Finesse	6.008
Surreptitious credit-taking	19.020
Ruthlessness	9.009
Luck	13.013
Hypocrisy	8.921

With this heretofore carefully concealed information now in the hands of Tom, Dick and Harry, a great injustice will soon be dissipated. Instead of a favored few being blessed with a lion's share of Success, Success will be equally divided among all, and nobody will have any to speak of.

Eureka, Nev., has been dying by inches ever since the furnaces and refineries closed down 25 years ago, writes Charles E. Van Loan in the *Saturday Evening Post* of Sept. 4, 1915. She may linger on for years to come, but so long as breath remains in the last inhabitant it will not be safe for the stranger to say Eureka is dead. Ore? They have trainloads of it—not so rich as it used to be, of course, for the old companies got the cream of it; but they only skimmed the top. Nobody knows what lies under the water in the Locan shaft on Ruby Hill. So Eureka waits. A traveling man passed through the town during Mr. Van Loan's visit. It was his first trip, the weather was very warm, the altitude bothered him, there was no ice to be had, his sales did not amount to much, and he had time to listen to the old men on the street corners. He paid them an entirely mistaken compliment before he cranked his roadster and sprinkled them with the dust of his departure. "The place is dead, but they don't know it," said he. "They can kid themselves along if they like, but they can't kid me. At that I've got to hand it to 'em—they're the greatest boosters in the world!" Thus he proved he knew neither the country nor the people.

An advertising circular of a recent book on Peru has been received, from which we purpose to quote at length. "All of the data in it is compiled from official sources of the Peruvian Government, and large quantities of gold dust have been panned out and obtained by the author's associates in Peru, and thousands of dollars of pure flake gold dust have been sold by the author at the United States Mint in Philadelphia, all of which has been panned out by hand from the golden streams of Peru." An illustration showing a large number of moving-picture actors, all looking proud, pleased and happy, is said to show "the art of panning gold from the sand and gravel of streams. Special instructions are given in the Guide enabling a greenhorn to successfully pan gold from the river-bed. The instructions are plain and simple, and easily learned by anyone. Working examples are given, so that the student may practice gold panning in his backyard by means of a wash-tub, from sand and gravel and a few grains of lead. This will make him expert enough so that when he reaches the field he will be able to pan and find color on any of the streams with ease." Except, of course, the gold be of the Santo Domingo variety, which can only be panned out by one who is used to that particular locality. We also learn that "the chinchilla is a native of the mountains of Peru and is worth $75 a dozen in New York City. Hundreds of these may be shot by any man handy with a shotgun," and shipped by wireless, we imagine. "The land cleared of its trees, with the exception of rubber trees, and other rubber trees planted in the same ground will produce on a 40-acre farm an income of $10,000 a year with little labor, and will support a family while waiting for the new trees to produce, which takes from five to eight years' time. Land may be purchased at $1 an acre." Now again we call your attention to the fact that all of this is not put forth with the idea of getting tourists, prospectors or rubber planters in South America, but merely for the sake of selling a book, at the small sum of $1.50 per volume. Do your Christmas shopping early while the first edition lasts.

PERSONALS

S. F. Shaw is visiting mines at Grass Valley, California.

Charles M. Schwab has been chosen a trustee of Cornell University at Ithica.

Charles A. Chase has changed his address to Suite 812-824, Cooper Building, Denver, Colorado.

E. Norris Hobart has been examining tungsten prospects in the Oscura Mountains in New Mexico.

Stanley G. Bullock, of the Poderosa Mining Co., Chile, has sailed for England to offer his services in the war.

H. Numato, engineer in charge of construction in the Imperial Steel Works, Japan, is a visitor in Baltimore.

Harlan H. Bradt is doing special work on iron ores for the Wisconsin Geological Survey. His present address is Lake Mills, Wisconsin.

Henry P. Day, superintendent of blast furnaces for the Tata Iron and Steel Co., Satchki, India, is making a vacation visit in this country.

George Kingdon, who had been spending a few days in Globe, Ariz., left Nov. 28 for the border to prepare for resumption of work at Cananea.

B. Magnus is on a trip which will take in Montana, Utah, Arizona and Tennessee to study modern practice at American copper mines and smelting works.

N. O. Lawton was in New York last week on professional business. He left Dec. 4 to examine and report on some mining properties, and will return to New York next week.

Dr. L. D. Ricketts and W. D. Thornton, vice-president of the Inspiration Consolidated Copper Co., have just completed an inspection tour of the property and of the International smeltery at Miami.

Dr. Charles R. Van Hise, the eminent geologist and president of the University of Wisconsin, is chairman of the commission appointed to investigate the slides in the Panama Canal and the probable causes.

Durward Copeland, professor of metallurgy at the School of Mines and Metallurgy of Missouri, sailed from New York Nov. 27 on the "St. Paul" for London, England, where he goes to make a study of the tin industry in Wales.

Edwin Higgins, engineer for the Bureau of Mines in the Lake Superior district, has been transferred to California, where he will take charge of the work for the bureau, which coöperates with the state in mine inspection work.

P. H. Mynahan, of Pittsburgh, formerly manager of the Louckes Iron and Steel Co., Roanoke, Va., is in Vancouver, B. C., engaged in the erection of a rolling mill for the Port Moody Steel Works Co., of which he has been appointed manager.

Benjamin B. Lawrence, a member of the class of '78, has purchased the Pelton-Doble water wheel and the Pelton-Francis turbine which were exhibited by the Pelton Water Wheel Co. at the Panama-Pacific Exposition, and has presented them to the Columbia School of Mines.

Herbert F. Black, who last week was elected a director of the Cambria Steel Co., has been with the Cambria company since 1912, in the capacity of ore agent, with offices at Pittsburgh. He is in charge of the production and shipment of materials entering into the manufacture of the company's products, including ore, coke, limestone, coal, ferromanganese, spiegel, etc.

OBITUARY

William Simpson Lyle died in San Francisco, Nov. 26, aged 78 years. He was born in Maine and went to California in 1852. He early began to invest in mines and owned many valuable properties. At one time has was associated with Clarence Mackay and James Fair. He was one of the earliest investors in Arizona mines.

Charles Edward Stafford died Nov. 27 at Haverford, Penn., aged 61 years. For many years Mr. Stafford was chemist at the plant of the Pennsylvania Steel Co. He was widely known for his improvements in openhearth furnace design. From 1885 until 1896 he was manager of the steel department of the Shoenberger Steel Co., Pittsburgh. He was also connected with the South Chicago plant of the Illinois Steel Co., and at one time was president of the Tidewater Steel Co., at Thurlow.

John Shaw Scott died at Salt Lake City, Utah, Nov. 30, aged 87 years. Born in Massachusetts, he went to California when a young man and lived in San Francisco for 10 years. In 1871 he went to Utah, where he formed the firm of Scott & Anderson, samplers and ore buyers, which for a number of years owned the Johnson Sampling Works at Sandy, Utah. He also owned interests in many Utah mines, especially those at Alta.

Adolphe Greiner, managing director of the John Cockerill Works, the important steel and ordnance works of Belgium, at Seraing, near Liège, and president of the British Iron and Steel Institute, died Nov. 20. It is generally understood that he refused to comply with German demands with regard to the operation of the works when the Germans gained control of that part of Belgium in the fall of 1914 and for a time at least was practically a prisoner in his own house. According to the report of the council of the Institute, printed in its 1915 volume, he "remained at his post, continually encouraging with his unfailing spirit the members of the staff of the Cockerill company and his workmen, and organizing means for the alleviation of the distress of the large industrial population dependent on the company for employment." Doctor Greiner's elevation to the presidency of the Institute was announced at its meeting in September, 1913, in Brussels, and he assumed office at the meeting in London, in May, 1914. His notable presidential address had to do with coke ovens, coke-oven gas and coke-oven byproducts, and with blast furnaces, blast-furnace gas and slags, cements, bricks, etc. He was 71 years of age. Since 1887 he had been managing director of the Cockerill Works, but his whole business life was devoted to this company, which he entered in his youth as a chemist after training at Liège School of Mines. The company adopted the basic bessemer process under his directorship. He was a pioneer in the utilization of blast-furnace and coke-oven gases for the generation of power in iron and steel works. He was president of the Central Committee of Industrial Labor of Belgium, president of the Geological and Mining Society of Belgian Engineers and an officer of the Legion of Honor. He was also past president of the Society of Engineers and of the Société d'Ingenieurs Sortis de l'Ecole Polytechnique. He held the Bessemer medal of the Institute and was the second foreigner on whom the Institute's presidency has been conferred, the other being Andrew Carnegie.

SOCIETIES

National Rivers and Harbors Congress—At the 12th annual convention in Washington, D. C., Dec. 8-10, a moving picture will be shown depicting the iron ore industry on the Mesabi Range, dockage facilities and methods at Duluth, and the manufacture of the metal in Eastern furnaces and mills.

University of Illinois—The members of the senior class of the department of mining engineering, have returned from their annual inspection tour of mines, which was in charge of Prof. E. A. Holbrook. This year, through the courtesy of the various companies, studies were made at the mines and plants of the Paradise Coal Co., Duquoin; Old Ben Mining Co., West Frankfort; Chicago & Carterville Mining Co., Herrin; and Peabody Coal Co., Mine No. 3, Marion. Afterward the party visited the offices of the Western Coal and Mining Co., St. Louis, where the office end of coal mining was explained. Following this several days were spent studying the lead mines and concentrators of the St. Louis Smelting and Refining Co., St. Francois, Mo.; St. Joseph Lead Co., Rivermines; and the Federal Lead Co., Flat River, Mo. The lead smeltery of the St. Louis Smelting and Refining Co., at Collinsville, Ill., was also visited. A similar trip is a yearly requirement for all students at the University expecting to receive the degree in mining engineering.

INDUSTRIAL NEWS

A series of three industrial motion-picture films, illustrating the manufacture of "National" pipe, from ore to finished product, will be shown before the Princeton Engineering Association at the Princeton Club, 121 East 21st St., New York City, Wednesday evening, Dec. 15, at 8:30 o'clock. No admission will be charged.

The Western Electric Co. has changed its Detroit headquarters from 263 Franklin St. to Kirby and Dequindre St. The new building is two stories high and has a frontage of 150 ft. and a depth of 130 ft. adjoining the Grand Trunk Ry.

in the section that forms a part of the inner belt railway of Detroit. The total floor space is 50,000 sq.ft., and the yard area 54,000 sq.ft.

The American Refractories Co., of Chicago, has leased the plant of the Buckeye Portland Cement Co. at Harper, Ohio, which is now being equipped and machinery installed for the calcination and production of dead burned magnesite on a large scale. Large tonnages of California magnesite have been purchased, and it is expected the plant will be in operation early in December. It will be run continuously until conditions in Europe permit a resumption of shipments from Austria.

The Russian Society for Electrical Enterprises, Ltd., 5 Marsowa Polje, Petrograd, which is the concessionare for electric-lighting stations in Pawlowsk, Uman and Kamenetz-Podolsk and of tramways in Elizabethgrad and Uman, has opened a branch for resale of electrical machines and apparatus, and insulating materials, and also of steam and naphtha engines as well as of water-turbines, and desires to enter into relations with first-class factories in the United States producing these goods with the view of becoming their agents in Russia. The company belongs to the Russian and French Bank, and offers the complete guarantee of this bank.

On Dec. 1 the Buffalo Foundry and Machine Co. opened an office in New York City in the Whitehall Building, 17 Battery Place. The company manufactures vacuum dryers of all types, dry vacuum pumps, condensers, vacuum drying and impregnating apparatus, Buflokast chemical apparatus, including complete plants and apparatus for the manufacture of aniline, phenol, beta naphthol, picric acid, caustic soda, acids, chemicals and kindred organic materials and "Bell" steam hammers. It also does a general jobbing, foundry and machine business, and can quote on castings up to 200 tons in weight each, including all necessary pattern and machine work.

At the Chemists' Club, New York City, on Nov. 10, a dinner was held to discuss plans for the next National Exposition of Chemical Industries, at which the following were present: Raymond F. Bacon, Chas. H. Herty, Henry B. Faber, A. D. Little, E. F. Roeber, George D. Rosengarten, T. B. Wagner, L. H. Baekeland, M. C. Whitaker, B. C. Hesse, Adrian Nagelvoort and Chas. F. Roth, R. G. Hollaman and F. W. Payne, all of whom will serve on the Advisory Committee for the 1916 National Exposition of Chemical Industries to be held at the Grand Central Palace, New York City, week of Sept. 25, 1916. At this meeting Dr. Charles H. Herty was elected to serve as chairman of this committee for the coming year. Plans for enlarging and increasing the scope of this coming exposition were laid. The plans include using several floors of the Grand Central Palace, with speakers in the evening and motion pictures during the day from 11 a.m. to 7 p.m.

The Wheeler Condenser and Engineering Co., of Carteret, N. J., has just issued two booklets, "Psychrometric Tables for Cooling Tower Work" and "Steam Tables for Condenser Work." The former includes in its contents an introductory discussion on psychrometry and tables giving the dry- and wet-bulb thermometer readings with the corresponding dew point, percentage of humidity, and pounds of water per thousand cubic feet of air over a wide range of temperature, together with an appendix on the sling psychrometer, with directions for its use in obtaining dry- and wet-bulb thermometer readings. The second contains a table of properties of saturated steam from 29.8-in. vacuum to atmospheric pressure, and the properties of saturated steam from 32° F. to 212° F.; in a third table the properties of saturated steam from 0-lb. gage pressure to 200-lb. gage pressure; with an appendix on the use of the mercury column for measuring pressures. These are both well gotten up, and are for free distribution to interested engineers.

TRADE CATALOGS

M. Smolensky Mfg. Co., Cleveland, Ohio. Catalog, Suction and Check Valves. 16 pp., illus., 6x9 inches.

The Denver Engineering Works Co., Denver, Colo. Bulletin No. 1,076, Ball Mills. 8 pp., illus., 8½x10½ inches.

The James Leffel & Co., Springfield, Ohio. Catalog No. 65, Steam Engines and Boilers. 32 pp., illus., 8½x11 inches.

The Gardner Governor Co., Quincy, Ill. Pamphlet, "Helpful Hints on Air Compressor Installations. 8 pp., illus., 4x9 inches.

Richardson-Phenix Co., Milwaukee, Wis. Bulletin No. 50, Phenix Force Feed Lubricators. 12 pp., illus., 8½x11 in. Bulletin No. 60, Richardson Model M Sight Feed Oil Pump. 20 pp., illus., 8½x11 inches.

Arthur H. Thomas Co., West Washington Square, Philadelphia, Penn. Bulletins of Chemical Apparatus. Illus., 8x11½ inches.

The Dobbins Core Drill Co., Inc., Singer Bldg., 149 Broadway, New York, N. Y. Catalog No. 16, the Dobbins Core Drill. 46 pp., illus., 8¾x5¼ inches.

Harrison Safety Boiler Works, Philadelphia, Penn. Pamphlet, "Finding and Stopping Waste in Modern Boiler Rooms by Use of Cochrane Meters." 68 pp., illus., 6x9 inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1,097, Power Transformers. 24 pp., illus., 8x10½ in. Bulletin No. 1,636, Hydraulic Turbines and Accessories. 56 pp., illus., 8x10½ in., Bulletin No. 1,801-A, Isbell Vanner. 22 pp., illus., 8x10½ inches.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

BLAST-FURNACE FLUE DUST—Pigment. Frank Orth, Indiana Harbor, Ind. (U. S. No. 1,161,790; Nov. 23, 1915.)

COATING IRON AND STEEL SHEETS with Lead and Lead Alloys. Reginald Hazeltine, Wheeling, W. Va., assignor to Wheeling Corrugating Co., Wheeling, W. Va. (U. S. No. 1,161,475; Nov. 23, 1915.)

DRILLING MACHINE. Mather W. Sherwood, Franklin, Penn., assignor to Chicago Pneumatic Tool Co., Chicago, Ill. (U. S. No. 1,161,259; Nov. 23, 1915.)

DRILLS—Means for Mounting Rock Drills. Otto Stuhaug Tonnesen, Johannesburg, Transvaal. (U. S. No. 1,160,672; Nov. 16, 1915.)

ELECTRIC FURNACE. Alex Dow, Detroit, Mich. (U. S. No. 1,161,634; Nov. 23, 1915.)

ELECTRIC FURNACES—Treating Materials in Electric Furnaces. Edward Salomon Berglund, Trollhättan, Sweden. (U. S. No. 1,160,244; Nov. 16, 1915.)

EXPLOSIVES—Apparatus for Testing Mining Powder. Francis I. du Pont, Wilmington, Del., assignor, by direct and mesne assignments, to Ball Grain Explosives Co., Wilmington, Del. (U. S. No. 1,161,462; Nov. 23, 1915.)

FUEL—Comminuted-Fuel Feeder. John F. Hay, Erie, Penn. (U. S. No. 1,160,283; Nov. 16, 1915.)

HOT-BLAST STOVE. Thomas Coultas and Thomas I. Coultas, Pittsburgh, Penn. (U. S. No. 1,161,031; Nov. 23, 1915.)

LAMP—Portable Acetylene Lamp. Augie L. Hansen, Evanston, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,161,209; Nov. 23, 1915.)

LIQUID-FLOW MEASUREMENT—Balancing and Measuring Apparatus. George H. Gibson, Montclair, N. J., assignor to Joseph S. Lovering Wharton, William S. Hallowell, and John C. Jones, Philadelphia, Penn., a firm doing business as Harrison Safety Boiler Works. (U. S. No. 1,160,275; Nov. 16, 1915.)

MAGNETIC ORE SEPARATOR. Samuel N. Smith, New York, N. Y., assignor of one-half to Herman W. Hoops, New York, N. Y. (U. S. No. 1,161,351; Nov. 23, 1915.)

NITROGEN COMPOUNDS—Method for Producing Nitrogen Compounds. Charles E. Acker, Ossining, N. Y., assignor to The Nitrogen Co. (U. S. No. 1,160,811; Nov. 16, 1915.)

PHOSPHATE—Method of Drying and Enriching Phosphate Material and the Like. Maximilian Mattheus Haff and Thomas Leopold Willson, Ottawa, Ont., Canada, assignors, by direct and mesne assignments, to Southern Investment Co. of Canada Ltd., Montreal, Canada. (U. S. No. 1,161,473; Nov. 23, 1915.)

PNEUMATIC TOOLS—Handle and Inlet-Controlling-Valve Construction for Pneumatic Tools. Francis A. Jimerson, Athens, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,160,617; Nov. 16, 1915.)

POTASSIUM SULPHATE—Process of Producing Potassium Sulphate. George S. Morgan, Toledo, Ohio. (U. S. No. 1,161,239; Nov. 23, 1915.)

REDUCTION—Method of Reducing Metals. John Woods Beckman, Berkeley, Calif. (U. S. No. 1,160,822; Nov. 16, 1915.)

SAFETY GLASSES—Eye-Shield Protecting Spectacles. Frederick Willson and Numa Bourquin, Reading, Penn., assignors to T. A. Willson & Co., Inc., Reading, Penn. (U. S. No. 1,161,100; Nov. 23, 1915.)

SLAG—Means for Utilizing the Heat of Molten Slag. Ralph Baggaley, Pittsburgh, Penn. (U. S. No. 1,160,817; Nov. 16, 1915.)

SMELTING—Method of Smelting and Incinerating. William R. Heslewood, Oakland, Cal., assignor, by mesne assignments, to Hydro Vacuum Smelting Co., Oakland, Calif. (U. S. 1,160,509; Nov. 16, 1915.)

SMELTING—Process of Smelting Ores. John H. Klepinger, Milo W. Krejci, and Charles R. Kusell, Great Falls, Mont. (U. S. No. 1,160,621; Nov. 16, 1915.)

SODIUM ALLOYS—Electrolytic Production of Sodium Alloys. Edgar Arthur Ashcroft, London, England. (U. S. No. 1,161,585; Nov. 23, 1915.)

STACK—Transversely-Bracing and Interlocking Hot-Air Stack of Rectangular Cross-Section. Albert G. Scherer, Chicago, Ill., assignor to The Excelsior Steel Furnace Co., Chicago, Ill. (U. S. No. 1,160,202; Nov. 16, 1915.)

TIN—Electrolytic Process of Detinning. Hans Goldschmidt, Essen-on-the-Ruhr, Germany, assignor to Goldschmidt Detinning Co., New York, N. Y. (U. S. Nos. 1,160,400 and 1,160,401; Nov. 16, 1915.)

Editorial Correspondence

SAN FRANCISCO—Dec. 1

Silver-Producing Camps in California and Nevada are encouraged to a point of enthusiasm by the rise in the price of silver. The recent strikes of high-grade ore in the Comstock mines and the continued development of ore of high value together with the price of silver, puts the Comstock in the best position that it has been for a number of years. Mining men from Tonopah and Virginia City declare that the production of those camps will be doubled in case the price of silver is maintained at the high figure now quoted. The principal silver-producing mines in California are in Shasta, Inyo, Calaveras, San Bernardino, Nevada, Amador and Tuolumne counties. Other counties producing silver and capable of increased production to an appreciable amount are Imperial, Kern, Mono and Yuba.

The Oil Industry Association, recently organized, is making strong efforts to induce the Government to withhold the filing of further withdrawal or other legal actions against operators of oil land in California, pending remedial action by Congress. There are 25 suits now pending in the U. S. Courts. In most cases receivers have been appointed. The filing and hearing of such suits has become so common as to attract but little attention outside the oil industries. The proposition of withdrawal of oil lands is obviously to conserve the oil in place for the benefit of the U. S. Navy. Two such Naval reservations have been made in the California oil fields, one of which embraces 30,000 acres of undeveloped land. In these cases the oil measures may be conserved without detriment to adjoining land; but to shut in fields developed by private enterprise and conserve such ground for the benefit of the Government would mean the loss of the oil instead of conservation of it, because such developed lands would be drained by adjoining operations, in most of the cases where the Government has brought suit. The enterprise and expenditures of oil men has made it possible in many instances for the Government to select undeveloped land. From such fields the Government can secure sufficient conservation for Naval supply. In one of these suits it was shown in the evidence that the operators had expended approximately $20,000 in sinking wells from March till January, 1909; and because they suspended work in August and did not resume until January, 1910, it would appear that the Government must take the land away from them and conserve it to the uses of the Navy. The interested oil men are slightly encouraged by the recent expression of Secretary Lane, that if the full measure of the Government rights is acted upon it will bankrupt many oil companies and do unnecessary injustice to men who have invested millions of dollars under a mistake as to the law. He believes that Congress should so act as to recognize the equitable rights of such operators. Secretary Lane offers no remedy, but merely says what might be done, then declaring that such plan is too liberal. What he suggests as might be done is that those who would today be entitled to patent, were the land not withdrawn, might have leases under which they will pay a liberal royalty to the Government.

BUTTE—Nov. 30

The City of Butte Will Be Compelled to Pay the damages sustained by property owners and business men who suffered loss when Miners' Union hall was dynamited on the night of June 23, 1914. In the District Court Judge Lynch instructed the jury to that effect in the case of Thomas Duffy, who had a saloon in the Miners' Union hall building at the time of the dynamiting. He had brought suit against the city of Butte for $7,100 to reimburse him for losses sustained when the enemies of the old Butte Miners' Union No. 1, attacked the hall and wrecked the building.

The Advance in the Price of Silver from 48c. per oz. to 56c. per oz. within a week's time has resulted in a boom in all of the north and west Butte districts. Fully 200 leasers have secured options on claims in the so-called silver district and are already beginning operations. Many of the abandoned mines are showing renewed life. If silver continues to rise in price and should go above 60c. per oz., silver production will easily be increased to 2,000,000 oz. per month. The Nettie mine in the western district which is now being unwatered has vast quantities of ore that runs high in silver. By the first of the year the Anaconda company will have this mine almost in readiness for operation. The Hibernia and other silver-mining properties close to it will probably be started soon after the Nettie resumes. W. A. Clark's new shaft at the Eveline is being sunk rapidly and this will open up some valuable silver-zinc orebodies, according to the expectations of the engineers who passed upon the property. Not since the early '90s has the activity in the silver properties been so great as at present.

DENVER—Dec. 2

Tungsten Has Been Known as one of the Silverton district's minerals for years, but no important effort to market the material was ever attempted until the recent advance in the market made the idea attractive. The new Colorado Metal Co. has rented the Yukon mill, on Cement Creek, and will use it to concentrate its ore from the Dawn of Day mine near Gladstone.

Cripple Creek's Total Production during November is placed at 82,830 tons of an average gross value of $15.66 per ton; the gross bullion value being $1,297,441. As usual, the great Golden Cycle plant at Colorado City handled far more than any other mill or smeltery, its tonnage for November being 37,500 or at the rate of 1,250 tons daily. The Portland mill at the same place treated 11,000 tons. The two Portland mills in the district are credited with the treatment of 27,500 tons of ore running $2.50 to $3 per ton.

SALT LAKE CITY—Dec. 3

The Utah Metal and Tunnel Co. of Bingham has taken formal possession of the Bingham-New Haven Copper and Gold Mining Co.'s property adjoining. The capitalization of the Utah Metal has been increased by 225,000 shares, the present authorized capitalization being 725,000 shares; the increase is to be used to take up the Bingham-New Haven shares. Before the increase there were 463,128 shares outstanding and 36,872 shares in the treasury. The company has a bonded indebtedness of $359,500, which it assumed when it took over the Bingham Central Standard ground. A final dividend of 20c. a share is being distributed by the Bingham-New Haven, amounting to $43,738. There will still remain $250,000 cash in the treasury, which will go with the property. The Bingham-New Haven stockholders will receive share for share of the Utah Metal stock. For the present the two companies will be operated separately, with E. P. Jennings and W. A. Barnes in charge of the Utah Metal end, and C. H. Doolittle, general manager of the Bingham-New Haven in charge of that end of the property. The work of the two companies will be gradually merged. W. E. L. Dillaway, secretary and treasurer of the company has been here looking over the affairs of both companies, and working out the details of consolidation. Shipments from the Bingham-New Haven at present amount to 230 tons of ore and concentrates a day. The company is milling 130 tons. The Utah Metal is shipping 110 tons a day, and it is hoped to have the combined output of the two companies up to 400 tons a day soon. The Bingham-New Haven ores are being shipped over the Utah Consolidated tramway to the International smeltery under a favorable contract, with several years still to run, and shipments from this end will be continued as heretofore. The Utah Metal end has been making arrangements for the extension of a railroad spur to its ore bins, which will cut out the half-mile wagon-haul down to the Utah Apex siding. This would mean a saving of upward of $10,000 a year. The orebodies in the two properties are closely associated, a recent strike of copper ore in the Bingham-New Haven making over into Utah Metal ground, and the large orebody in the Utah Metal being close to the line. The consolidation will be of benefit to all concerned, and will prevent possible litigation.

WALLACE, IDAHO—Nov. 30

The Bunker Hill & Sullivan company is still "up in the air" with respect to the location of the smeltery. With satisfactory freight rates there appears to be no doubt that it will be located adjacent to the mine at Kellogg. It is understood that the management prefers Kellogg, and will place the plant there unless there is too great a disparity in the bullion freight rate between Kellogg and the coast. Strong pressure is being brought to bear to secure a favorable rate for Kellogg, and in this the business men of Spokane are heartily coöperating. It may be several weeks before the question is settled, but it looks like Kellogg.

DULUTH—Dec. 4

Navigation Will Close at the Head of the Lakes on Dec. 6. Every dock but the Great Northern showed a substantial increase over 1914. The following tonnage figures are subject to slight corrections, but are substantially correct.

Dock	1915	1914
D., M. & N.	15,437,419	6,318,295
D. & I. R.	8,642,942	5,579,929
N. P.	173,047	137,664
Northwestern (Ashland)	4,134,000	2,605,275
Soo (Superior, Wis.)	960,595	721,662
Soo (Ashland, Wis.)	1,012,773	758,144
	30,360,776	16,120,969

The docks at Marquette and Escanaba, Mich., will continue shipping for another week, which prevents securing grand total of tonnage at this time.

Litigation Is Expected as a result of a recent decision by the U. S. Supreme Court that the natural channel of the St. Louis River was the boundary between Minnesota and Wisconsin. The large modern coal docks of the Carnegie Coal Co. and the Zenith Coal Co., on the Minnesota side, extend beyond this line as originally surveyed. Litigation is now expected wherein the property owners on the Wisconsin side opposite will claim ownership of the ends of these docks, because of riparian rights from the water line to the center of the channel.

The Railroads that Haul Iron Ore from the Minnesota ranges to the docks at the head of Lake Superior are figuring on a greatly increased tonnage next season. Heavy orders are being placed for rolling stock. Cars were greatly in demand this year, but it is predicted that 1916 will be the banner year in the iron-ore trade, and every ton of ore that the boats can handle will be taken down to lower lake ports. The Duluth, Missabe & Northern road placed orders this week for two grade-climbing Mallet compound locomotives, six locomotives of the Santa Fé type, similar to those used on that road's mountain division, 1,000 steel hopper ore cars and 200 steel hopper coal cars. The ore cars will be furnished by the Western Steel Car and Foundry Co., of Hegewison, Wis., and the Pullman Car Co. will make the coal cars. The Duluth & Iron Range road has ordered 750 steel hopper ore cars from the American Car and Foundry Co. and the Standard Steel Car Co., and three Mikado locomotives for heavy freight service. One new dock is to be erected at Two Harbors by the Duluth & Iron Range road, as there is not storage space enough at the present time to take care of any great tonnage. One of the old wooden docks will be torn down and replaced by a larger one of steel and concrete. Considerable money will be spent by the Missabe road in improving and increasing the road's terminals at Proctor, and putting in additional track scales, which will be needed to meet the demand. The year 1916 is going to be an interesting one for the iron ore operators, the railroads and the boat lines, as there will be increased rates for hauling for the lake carriers, and the mining companies expect to receive at least 75c. more for their product than they have been getting the last two years.

GLOBE, ARIZ.—Nov. 30

Asbestos Mining on Ash Creek, 40 mi. northeast of Globe, is on the increase. The best-developed property is that of Fisk and Snell who have just completed a mill and are preparing to extract asbestos on a large scale. Altogether 3,400 ft. of development work has been done. Shipments averaging one ton per day have been going out on burros to Globe and to Rice on the Arizona Eastern R.R. Another property, part of which adjoins the Fisk and Snell claims and in which H. Kenyon Burch is said to be interested is to be opened up; work is scheduled to start next week.

A Shipment of Tungsten Ore was recently sent to the Primos Chemical Co. by Victor Jackson, who is leasing on the claims of the Powers Gulch Development Co. Jackson was employed to do assessment work on the company's property of 22 claims on the Gila and Pinal County line. He recognized as tungsten ore what had formerly been mistaken for rich copper ore and sent a sample to the Primos company which sent a representative to the property with the result that 831 lb. recently shipped brought $559 less freight. In all 2,000 ft. of development work has been done on the property; one shaft having been sunk to a depth of 104 ft. and another to 176 ft.

Work on Prospects in the Globe District on the eastern slope and foot-hills of the Pinal Mountains southeast of Globe has aroused no little interest locally, as important discoveries of gold-copper ore have been made. On one of these a shaft has been sunk to a depth of 26 ft. in ore averaging $17 per ton in gold, in another some $100 gold ore has been found, but the vein, which is between diorite and schist, carries copper as the chief metal. In one of these properties, the Logan, 2,000 ft. of development work has been done and some high-grade copper ore carrying about $8 gold is to be taken out for shipment to the smelter. The low-grade is commercial concentrating ore. Gold ore is being mined by leasers on the southwestern slope of the Dripping Springs range north of Hayden. The low-grade ore assays $16 per ton but some of the leasers have run across a little high-grade specimen ore that runs up to $8,000 or $10,000. The vein is exposed in the hill and highgrade is found at depth.

The Christmas Mine a few miles above Winkelman will become an important producer by the first of the year. Christmas is now the terminal of the Phœnix & Arizona Eastern R.R., connections with Globe being made by auto-stage three times weekly. A small tonnage of ore is now being shipped regularly to the smeltery at Hayden; most of it being produced by leasers who are gophering into the hill along the outcrop of the load and transporting the ore down to the railroad terminus by burro. The Christmas mine was acquired by the A. S. & R. Co. this summer and is being put in condition for regular production, when 250 to 300 men will be employed. The work for the last few months has comprised building an ore pocket at the railroad terminus and another with crushing machinery just east of the main shaft; a wire-rope aërial tram, 7,000 ft. long, connecting the mine pocket with that at the railroad. The track cables have just been strung and when in operation it is calculated that about 25 hp. will be developed in excess. Electric power will be brought in from Hayden. The ore is bornite, chalcocite, chalcopyrite and pyrite in a garnetiferous gangue; the deposit being in a contact of limestone with granitic-porphyry. The orebody is wide and persistent with prominent outcrops and is said to be well developed down to a depth of 800 ft. The work is being done under the supervision of S. H. Sherman, who has been connected with the property for several years. The property was one time owned by the Saddle Mountain Mining Co. in which New Haven people were interested and by the Gila Copper Sulphide Corporation.

HIBBING, MINN.—Nov. 27

Tax Dispute between the mining companies and village officials was amicably adjusted on Nov. 23 at a conference in the city hall. The mining companies are to pay their taxes in cash within three weeks, except that they may pay in one-half of the village water-works warrants which they now hold. In return, the village is to limit its expenditures to $24,500 per month, except as to payments on certain outstanding contracts, or emergency expenditures. All litigation between the village and mining companies is to be abandoned. The proposed $1,900,000 tax levy for 1916 is likewise to be abandoned.

METALINE, WASH.—Nov. 30

Activity in the District is slowing up on account of the season, but prospects are that there will be a considerable amount of work undertaken in the spring. At present the Metaline Oriole Co. has started work in the lower tunnel to drive to the ore which was cut off by a fault. The Milwaukee Ltd., is asking for bids for 100 ft. of tunnel work, which it expects will cut the main vein. The Lead and Zinc Co. is working 25 men. The mill has been enlarged and is now awaiting the arrival of new machinery. It expects to be running at full capacity by the end of the year. The Riverside property is surveying its ground for a patent.

ATLANTA, IDAHO—Nov. 23

Considerable Activity, considering the handicap, is noted in the Atlanta district. The Boise-Rochester, which took over all the old Bagdad-Chase property, including 40-stamp mill, power plant, tram line, etc., has acquired additional ground—Old Chunk and Webfoot claims. The mill is dropping 20 stamps; the remaining 20 will be operated as soon as sufficient ore is blocked out. T. C. Brown, inventor of the Pachuca tank, has charge of the mill and is erecting an experimental cyanide plant to handle the concentrates. If this proves successful, the plant will be altered next summer to an all-slime cyanide mill. The ores of this district have been difficult to treat, and many failures have been made. The ore averages about $10, of which about 60% is saved by amalgamation, 20% on the concentrators, and 20% goes into the tails. The camp is handicapped by being 80 mi. from the railroad, and wagon roads over the mountains are closed six to seven months a year; the freight rate is $40 per ton when the roads are good. The district is in a forest reserve, and the Government exacts payment of 1c. per ft. for timber, 1c. apiece for lagging, $2.50 per M for lumber, and 65c. per cord for wood, for all such material used. The veins of the district are all soft, and close timbering is required, so that these fees to the Government seem to be a hardship to the miner. The Overlook Mining Co., 16 mi. from Atlanta, is installing a 10-stamp mill, Bleichert tramway, etc. S. A. Work is superintendent. Twenty-five men are working there.

The Mining News

ALASKA

ALASKA MEXICAN (Treadwell)—During October crushed 19,075 tons. Total yield per ton of ore milled, $1.43.

ALASKA TREADWELL (Treadwell)—During October crushed 82,593 tons of ore. Estimated gross realizable value $153,415.

ALASKA GOLD BELT (Juneau)—Face of tunnel was in 2,300 ft. on Nov. 26. Main orebody is expected to be cut at 2,500 ft.

ALASKA UNITED (Treadwell)—Started up 30-stamp addition to R. B. mill, Oct. 24. During October R. B. mill crushed 22,848 tons of ore and 700-Ft. mill 23,170 tons. Yield per ton of ore milled, $1.84 and $1.30 respectively.

ARIZONA

Cochise County

MASCOT COPPER (Mascot)—Shipped 1,256 tons of ore to smelters in October. Company has ordered new consolidation Baldwin locomotive.

CARTWRIGHT MINES (Johnson)—Virginia-Arizona Copper and Smelting Co., organization of Douglas men, has acquired Cartwright group in Winchester district southwest of Johnson.

MILLER CAÑON (Hereford)—News of a gold strike Saturday, Nov. 27, precipitated somewhat of a rush for this district. Miller Cañon is situated in the Huachuca mountains, few miles south of Hereford, and was located as placer ground.

Gila County

ARIZONA COMMERCIAL (Globe)—Reported to have decided to erect $50,000 power plant and discontinue using Old Dominion power.

NEW KEYSTONE COPPER CO. (Miami)—Company has now been dissolved. Distribution of 93c. per share upon outstanding stock of the company of the par value of $1 per share has been declared in full and final distribution of assets of company.

Greenlee County

THE FEDERAL INVESTIGATORS in the Clifton-Morenci-Metcalf strike district, Messrs. Davies and Myers, have completed their work after taking many affidavits at the three camps.

Maricopa County

MAX DELTA (Phœnix)—Plans to build mill at mine, 9 mi. south of Phœnix. Former United States Senator Lee Mantle, of Butte, Mont., is president.

Mohave County

TOM REED MINE (Kingman)—Cleaned up $100,000 in October.

GOLCONDA (Kingman)—Is now working 265 men and producing $250,000 monthly.

GOLD ROAD BONANZA (Gold Road)—Work has been started on 2-compartment shaft, to be sunk 200 ft.

COPPERFIELD (Mineral Park)—Copperfield Porphyry Copper Co. incorporated to develop 120 acres around Ithaca Peak.

NELLIE MINING CO (Kingman)—Contract has been let for 4½x8x500-ft. shaft. Automobile road to property is being built.

SILVER & BIG BETHEL (Kingman)—Situated on Golconda vein. Has been sold to C. B. Bell and associates of Douglas.

MAZONA MINING CO. (Oatman)—Will start sinking 500-ft. vertical shaft upon its group of nine claims, adjoining Tom Reed and Gold Cliff mines on west.

SHOOTING STAR (Chloride)—Kingman Zinc Mining Co. has taken over Fountaine, Cupel, Robinhood and Shooting Star mines in the Stockton Hill district of Cerbat.

OATMAN BIG LODE MINES CO. (Oatman)—Preparing to start development work upon a group of six claims which it has acquired from D. P. Mitchell and associates.

CARTER M. & M. (Kingman)—Proposed 500-ft. shaft now down 250 ft. A 4-ft. vein assaying $14 was discovered in winze 20 ft. from southeast drift on 150-ft. level.

GOLD ORE (Gold Road)—Drifting on 500 level is being pushed. Thirteen feet of $40 ore has been encountered in east drift and 9-ft. vein assaying $100 has been found in tunnel going west.

OATMAN SECRET GOLD MINING CO. (Oatman)—Composed of prominent Arizona men, has just been organized to take over Gold Coin group. Wagon road to property is being constructed and bunk and cook houses are being built. A 50-ft. shaft will be sunk immediately.

OATMAN SYNDICATE MINING CO. (Oatman)—J. Parke Channing, consulting engineer of the Adolph Lewisohn interests, of New York, and associates have organized the Oatman Syndicate Mining Co., which has taken over the Putney group of 12 claims belonging to H. G. Putney, in Oatman district. A 500-ft. vertical shaft will be sunk and other development work done.

UNION BASIN (Golconda)—Expects to finish construction of 200-ton flotation plant about middle of next month. Its new high-tension electric-transmission line being built from Kingman to the Golconda mine, 20 mi., will be finished about same time. Controlling interest in the company is owned by N. L. Amster, of Boston, Mass., and associates. Mine is now producing between $200,000 and $250,000 gross, monthly. Main shaft has reached 900-ft. depth and station is now being cut.

Pima County

STRATTON COPPER CO. (Tucson)—Plans to build new concentrator at its mines in Catalina Mountains. Will have daily capacity of 500 tons.

PIONEER SMELTING (Corwin)—By a ruling of the state supreme court upholding Pima County Superior Court, Messrs. Walker, Zipf and Dickson, trustees in bankruptcy of the Pioneer Smelting Co., recovered on note for $31,000 and foreclosure on some mining claims.

Yavapai County

PORTLAND ARIZONA (Copper Basin)—Preparations being made to install large compressor.

COPPER CHIEF (Jerome)—Hayden Development Co. is erecting 200-ton mill. Reported 500,000 tons ore blocked out.

HÜBNERITE has been found in Eureka district. Claims adjoin holdings of Lawler, Wood and Connor, who have already made shipments of this ore.

PFAU COPPER (Prescott)—A. L. Garford, automobile manufacturer, has bought controlling interest in this mine in the Cherry Creek district and has let contract for much exploration.

RANDOLPH-GEMMILL DEVELOPMENT (Crown King)—Reported to be successfully treating refractory ores of that district. Milling 100 tons daily of old Crown King dump on lease. Will enlarge plant to treat custom ore.

MERRILL METALLURGICAL CO. (Prescott)—Negotiations for sale of Congress gold mine by Development Co. of America to Merrill Metallurgical Co. of San Francisco practically closed. Extensive dump is to be treated.

UNITED VERDE EXTENSION (Jerome)—Producing 40 tons daily, of which 10 tons average about 45% copper. Eighty men employed. Hoist being installed to handle ore from 1,400-ft. level and work is progressing on new tramway to supplant burro transportation from mines to railroad.

BROOKSHIRE (Jerome)—Green Monster Mining Co. has been organized to take over Brookshire, Treadwell, Layman and Clark-Hopkins groups in Jerome district. Consolidation embraces 30 patented and 26 unpatented claims, lying between United Verde and United Verde Extension. Identified with new company are N. E. Bailey, superintendent of United Verde & Pacific; Leroy Anderson, attorney for United Verde, and Thomas Taylor.

CALIFORNIA

Contra Costa County

VALLEY PIPE LINE (Martinez)—New line completed, extending from oil fields at Coliola, Shell tank farm, a distance of 157 mi. to Martinez. Capacity of line, 25,000 bbl. per 24 hr. Expected that this line will supply demand of refinery. Shell company has installed 35 additional 55,000-bbl. tanks, to increase storage capacity at refinery.

Butte County

JOSEPHINE-BUMBLEBEE (Oroville)—Preparations being made for development and extraction of ore. Installation of new mill of 25 tons' capacity contemplated; machine drills will be installed.

Calaveras County

SUMMERVILLE (Angels Camp)—New shaft will be deepened to 800 ft. Overhauling 40-stamp mill.

SOMMERVILLE (Angels Camp)—New shaft near Forth crossing is down 130 ft. Property former producer. The 40-stamp mill is being overhauled. Old 800-ft. shaft has been abandoned.

Imperial County

NEW LIVERPOOL SALT CO.—Claim against California Development Co. is under option to Imperial irrigation district, El Centro. Terms are $600,000 in bonds.

MODOC MINES (Highgrade)—N. E. Guyot, manager, is getting in winter supplies. Drift at 200 level has encountered vein which was disclosed on 100 level. Shaft will be deepened to 300 ft.

Inyo County

KEANE WONDER (via Rhyolite, Nev.)—Property has just come into possession of its new owners: Francis-Mohawk Mining and Leasing Co. of Goldfield, Nev.; F. L. Wildes, receiver of State Bank and Trust Co.; and B. F. Tatem, of Montana. Property was sold in November, 1914, to satisfy judgment. Equipment consists of 20-stamp mill, cyanide plant, and aërial tram mine to mill. Operations are to be resumed.

Mono County

PITTSBURG-LIBERTY (Masonic)—Mill operating full capacity on ore, chiefly from Golden Serita where good ore has been disclosed on 100 level. Some high-grade with milling ore. Development in Pittsburg-Liberty mine progressing satisfactorily. New York claim has been acquired by J. D. Martin and development started.

Nevada County

BLACK BEAR (Grass Valley)—New compressor and air pump of 300-gal. capacity being installed.

CONLIN (Grass Valley)—Alfred B. Swinerton, R. M. Hotaling and others, of San Francisco, have examined and are reported to have begun negotiations for purchase of property. Mine was formerly producer of high-grade ore.

COLUMBIA (Washington)—Ten-stamp mill crushing 50 tons of ore per day. Large amount of ore blocked out and reserve broken down. Compressed-air drills are used in drifts. Mine will operate all winter regardless of weather.

POLAR STAR (Grass Valley)—Ten men are employed and number will be increased as soon as living quarters are provided. Electric hoist and pump about ready for installation. Property adjoins North Star. Salt Lake men are operating. Oscar Cofline is superintendent.

EXCELSIOR (Forest Hill)—Second unit of three stamps has been added to mill and third is in course of construction in San Francisco. Reported that mill is crushing 100 tons of ore per day. New office building and five new residences have been built, giving camp a prosperous appearance.

OCEAN STAR (Washington)—Property which is owned by Englishmen will be reopened, with N. M. Melrose superintendent. Winter supplies have been ordered and development started. Recent financial difficulties said to have been adjusted to permit resumption of work. Shaft will be deepened and mill capacity increased.

Plumas County

ENGELS (Taylorsville)—Preliminary railroad survey on mine to Western Pacific R.R. about completed.

NEW YORK (Greenville)—Work in No. 3 crosscut will be renewed and extended until the vein is encountered.

STAUFER (Greenville)—Superintendent Elliott reports everything in readiness for winter work and probability of extensive development.

Sierra County

SOUTH FORK (Downieville)—Mason gravel claims bonded to Thomas Wilson of Manhattan, representing a Nevada company, who will soon begin active work.

MONARCH (Sierra City)—Richest and most important strike in 20 years in Sierra City district recently made here. Ore averages thousands of dollars per ton gold. This mine is on serpentine belt on which old and rich Sierra Buttes mine is located, and is being developed by R. G. Gillespie, of Pittsburgh, Penn. Extensive surface and power plant built during past year. Large restraining dam being built to hold tailings, and all preparations for continuous work on large scale at both mines during winter. D. McGonigal, superintendent.

Shasta County

REID (Redding)—New vein reported on 700 level. If ore proves to be medium grade, preparations will be made for extensive development, as orebody is said to be large.

ELDORADO (French Gulch)—James Connor, owner of this mine on Clear Creek near Tower house, is mining high-grade ore and treating it in two-stamp mill. Last cleanup returned $400 from 10 days' run.

HAY FORK VALLEY DREDGING GROUND reported at Weaverville to have been bonded to G. E. Hunter. There is large acreage in valley and it is believed that good proportion of it will prove valuable for dredging.

GLADSTONE (French Gulch)—Reported that ledge which was lost on 1,200 level has just been disclosed on 1,300 level. Number of men reduced in September, 75 being laid off and 32 retained to carry on drifting on 1,300 level. Gladstone is one of large producers of state and within past year or so has made important improvements including a steel headframe. J. O. Jilson, manager, and Edward L. Young, superintendent, were both confident that orebody would persist to and below 1,300 level.

GOLDEN JUBILEE (Carrville)—Mine taken over by California Extracting Co. of San Francisco. Purchase price said to be $50,000. Mine was located in 1896 and developed into good producer. Ores near surface were free-milling, but at depth refractory sulphides were encountered. Recently 40-ton cyanide plant was installed. Property was owned chiefly by McCormick-Saeltder Co., of Redding. Present operators contemplate installation of a tube mill and adoption of Vandercook process.

COLORADO

Clear Creek County

ONEIDA (Freeland)—Body of rich gray-copper ore has been opened in raise extended to height of 150 ft. at point about 1,000 ft. from portal of the Stag tunnel. Last 25 ft. of raise is in ore. Vein is 5 ft. wide and assays 0.52 oz. gold, 10 oz. silver and 4% lead.

UNITED FREELAND DEVELOPMENT AND TUNNEL CO. (Idaho Springs)—Property of this company, embracing over 100 patented lode mining claims and several millsites and tunnel sites, has been purchased by syndicate of Chicago and St. Louis capitalists, who have planned campaign of extensive development through McClelland tunnel. Portal of tunnel is located about 5 mi. west of Idaho Springs and one mile east of Dumont. Tunnel is now 7,150 ft. long. New company plans advance of 3,000 ft. to develop Freeland and Lamartine districts. Connection will be made with old Freeland shaft and workings will be drained. This connection will require 1.100 ft. of tunnel and 1,000 ft. of raising. It is probable that Lamartine, Gum Tree, Oneida, Lone Tree and Freeland Extension properties will all be benefited by new development. Company contemplates construction of a modern milling plant at portal of tunnel, for treating its own ores and product of properties tributary to tunnel. L. W.. Shaffer, of Idaho Springs, has been appointed general manager.

Lake County

DOWNTOWN PUMPING CO. (Leadville)—Has experienced provoking delays due to motor troubles, centrifugal pumping units having been idle at intervals that permitted heavy flow of water into old workings of Penrose and neighboring mines to gain appreciably on unwatering operations.

Ouray County

CAMP BIRD, LTD. (Ouray)—In October crushed 2,730 tons ore; estimated profit, £11,500.

IDAHO

Shoshone County

HECTOR (Wallace)—Long crosscut expected to cut vein 3 miles from portal has reached position vertically below outcrop, depth of 1,800 ft.

INTERSTATE-CALLAHAN (Wallace)—Judge Deitrich of Federal court has issued order discharging receiver appointed by Judge Woods of state court for this company.

BROWN & FINNELL (Pine Creek)—Operators have bonded Pine Creek antimony property to Burke McIntosh and associates, of Kellogg. New owners plan mill to treat entire mine output.

CLIMAX (Wallace)—Building has been erected for 10x10 compressor and 35-hp. motor, which will be installed at once, contract having been made with Washington Water Power Co. for current.

NATIONAL (Mullan)—National mill started Nov. 11. Only one shift is being worked now. National ore is low-grade copper, average probably not exceeding 2%, but carries considerable silver. Large amount of ore blocked out.

TAMARACK-CUSTER (Wallace)—Reports emanating from reliable sources, state that Tamarack-Custer is negotiating with Ray-Jefferson company to join in construction of mill to treat output of both properties, which lie near each other in Nine-Mile district of Cœur d'Alenes.

GETTYSBURG (Mullan)—Official statement from W. E. Cullen, secretary Independence Lead Mines Co., who is also secretary of the Stewart Mining Co., reports work concentrated in No. 4 tunnel of Gettysburg, from which raise will be made to No. 3, in which there is large body of lead ore. This is known as Gettysburg vein, extension of You Like. No. 4 tunnel also being extended to cut Morning vein.

MICHIGAN

Copper

COPPER PRODUCTION from the mines of the Michigan district ran close to 25,000,000 lb. for the month of November, and for December the product will be over 23,000,000 lb. refined, if the present basis of operation is maintained. Production for the Lake Superior district for the present year is estimated at more than 250,000,000 lb. The average price for the year will be above 16c.

AHMEEK (Kearsage)—Is producing larger tonnage of copper rock than ever before in its history and percentage of copper content is above average for Kearsarge formation, although not quite up to last year or year before for Ahmeek. Mill now is operating six heads and handling an average of 100,000 tons of copper rock each month, so that production is at rate of about 25,000,000 lb. per year.

CALUMET & HECLA (Hubbell)—Third of large furnaces for smelting plant at Hubbell now under construction. Work will be continued during winter. New furnace will have capacity of 150,000 lb. and will have electric equipment for loading and dumping. It is modeled after No. 20 and No. 21, each of which has capacity of 150,000 lb. The C. & H. smelting and refining plants now have payroll of 500 men, twice what it was year ago.

Iron

ODGERS (Crystal Falls)—Shaft sinking was started this week.

L. S. & I. RY. (Marquette)—Four new locomotives are to be ordered for ore hauling.

PIONEER IRON (Marquette)—Ten more retorts are to be added to the furnace plant. Ten are now being constructed.

CLEVELAND-CLIFFS IRON (Ishpeming)—At special meeting of shareholders, held Dec. 1, it was decided to increase capitalization of company from $5,000,000 to $10,000,000.

AMERICAN (Diorite)—Two electric pumps now taking water from big swamp that overlies part of orebody. Water level was lowered 30 ft. by sinking 6 large sandpipes and forcing water to surface by air.

MINNESOTA

Mesabi Range

BARNETT & RECORD (Two Harbors)—Has been awarded contract for dismantling No. 2 Dock of Iron Range R.R., which is to be superceded by $1,500,000 steel and concrete dock. Old No. 3 Dock will not be torn down until completion of the new dock.

ARTHUR MINING CO. (Hibbing)—Three large steam shovels have been ordered from the Bucyrus Co.; will weigh 315 tons each. Booms will be 75 ft. long; dipper capacity will be 7 yd. Will be possible to make cut 50 ft. deep with them. Three Osgood shovels have also been ordered. Eight new locomotives will be delivered before spring.

LEONARD NO. 2 (Chisholm)—Electric locomotives operating on stockpile are handling three cars each, all side-dump. Ordinarily but one car is used, but change is necessitated because of unusual length of the stockpile. Distance to be trammed is so great that hoisting would be delayed if but one car were used.

MONTANA

Beaverhead County

BANNACK GOLD (Bannack)—Reported that ore assaying 36.8 oz. in gold and 43.7 oz. in silver was encountered in No. 2 Thompson stope of Golden Leaf mine. It has been opened up at a point about 280 ft. from surface. Company has blocked out in neighborhood of 160,000 tons of milling ore. It has been decided to block out at least 200,000 tons before beginning construction of amalgamation and cyanide mill, which will probably be started Mar. 1.

Blaine County

LITTLE ROCKIES DISTRICT—Considerable mining excitement around Landusky, Whitcomb and Ruby Gulch; gold-bearing claims being worked on increasing scale. Mining at Zortman has been in progress for years. Eastern capitalists have taken options on claims, aggregating in value $150,000, and installation of big mining plant near Landusky may follow.

Deer Lodge County

WASHOE REDUCTION WORKS (Anaconda)—Construction work is making rapid strides. New roaster building is nearing completion and bricklayers are now busy on building and lining roasters. Large flue for roasters was started last week, also erection of 1,000-ton coal bin for pulverizing plant. Slime-flotation building is also nearing completion and concentrate tank-house is being retimbered.

Lewis & Clark County

SCRATCH GRAVEL MINING DISTRICT—Resumption of operations at Head properties in this district by John MacGinnis, H. I. Wilson and associates of Butte, and fact that they are taking good pay ore out of property, has started great amount of prospecting in adjoining claims and has created mild boom in district.

Silver Bow County

ANACONDA (Butte)—Work on old Alice mine at Walkerville, stopped for some time because of litigation, resumed.

EAST BUTTE (Butte)—Now producing at rate of 20,000,000 lb. of copper per annum at a cost of 10c. per lb. New flotation plant is practically ready for operation.

BUTTE-DULUTH (Butte)—Capt. A. B. Wolvin, who owns three-fifths of stock and some bonds of company, will soon announce arrangements made for taking care of most pressing claims and property, only one now idle in Butte, will be operated again.

DAVIS-DALY (Butte)—About 75 tons of ore per day being mined and shipped from Colorado mine, running about 7% in copper. It is probable that November profits will amount to $10,000. Planning to install new hoisting engine; also to cut out shoulder between 1,700 and 1,900 levels to make three-compartment shaft down to 2,500 level, which would enable company to increase output to 400 tons of ore per day.

NEVADA

Esmeralda County

JUMBO EXTENSION (Goldfield)—During quarter ended Sept. 30 shipped 8,354 dry tons, gross value $325,040, on which the smelting loss was $37,721, freight and treatment $73,274, sampling $5,406, and mine costs $47,348, leaving net realization of $161,289.

REORGANIZED KEWANAS (Goldfield)—On 840 level from main winze and about 300 ft. northerly from it, new winze has been started on vein near hanging wall to go to latite-shale contact and explore vein at that horizon.

GOLDFIELD CONSOLIDATED (Goldfield)—Production for October was 36,500 tons and net realization $98,375. Net operating costs were $4.40 per ton. Leasers produced 119 tons valued at $3,995. Ore transportation to mill over Consolidated line now being handled under contract by T. & G. railroad.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 27 was 9,951 tons, estimated value $205,078, compared with 10,093 tons for week previous. Producers were: Tonopah Belmont, 3,006 tons; Tonopah Mining, 2,900; Tonopah Extension, 1,850; Jim Butler, 1,100; West End, 647; North, Star, 52; Halifax, 49; miscellaneous leases, 347 tons.

HALIFAX-TONOPAH (Tonopah)—On 1,200-ft. level at point of recent ore discovery, work of cutting station and installing hoist at collar at 40-ft. winze completed and sinking resumed. Progress at Halifax is being watched with interest as it holds large possibilities in eastern extension of Tonopah's proven ore zone.

TONOPAH BONANZA (Tonopah)—Greenwater Copper Mines and Smelting Co. through purchase of 290,000 shares of treasury stock and other large interests has acquired control of this property from Herman Zadig, of San Francisco. John Magee has been appointed superintendent. Although no details have been given out, it is stated that shaft, which has present depth of about 1,040 ft., will be equipped to sink to 2,000-ft. mark. This marks entrance of another strong company into development of Tonopah's western section.

Storey County

ANDES (Virginia)—Saved 10 cars ore from stope above 175-ft. level.

SIERRA NEVADA (Virginia)—From stope in 2,500 level shipped 91 tons to the mill; average assay $14.22 per ton; southeast drift from west crosscut in low-grade ore.

CROWN POINT-BELCHER (Gold Hill)—Extracted 251 cars of ore from No. 1 stope on 1,600 level and shipped 575 tons of dump rock and 225 tons of mine rock to the mill; bar of bullion shipped.

UNION & SIERRA NEVADA (Virginia)—Joint east crosscut from 100-ft. point in raise above 2,500 level shows face of $50 ore. Saved from this work 28 cars of ore averaging $65.48 per ton.

MEXICAN (Virginia)—East crosscut 2,700 level in porphyry and quartz of low assay. Mexican mill crushed 168 tons of custom ore, average assay $25.63 per ton. Mill idle 4 days on account of delayed shipment of zinc dust.

OPHIR (Virginia)—In southwest drift 2,500 level, at 271-ft. point 4 ft. of low-grade quartz exposed in upper blast; porphyry and quartz also at 126-ft. point. Central tunnel north drift in milling quartz over 2 sets wide. Saved from stopes 362 cars of ore and milled 331 tons.

UNION (Virginia)—From north end No. 3 stope 2,500 level saved 14 cars averaging $10 per ton; from south end saved 21 tons averaging $33.42 per ton. Saved from raise No. 1 14 tons, averaging $21. Top of raise in $19 ore. Sill floor northeast drift shows $10 ore in face.

UTAH

Beaver County

FORTUNA GOLD QUEEN (Beaver City)—Being prepared for more extensive development; lumber for four buildings has been received; expected to have these ready before cold weather sets in. Considerable opencut work is being done. Ore from Davis lease has been tried out at Sheep Rock mill, and good saving made. Ore has been opened on another lease, and work is being done to cut extension of vein productive in Davis lease.

Juab County

UNCLE SAM (Eureka)—Tunnel being driven to prospect for continuation of recent Yankee strike. Leasers are mining some ore in old workings.

RIDGE & VALLEY (Eureka)—Lead-silver ore of good grade has been opened from 1,600 to 1,670-ft. level, and is being mined. Workings are being put in shape for increased production.

Salt Lake County

SOUTH HECLA (Alta)—Face of 500 level, which is being driven on Wedge fissure, is heavily mineralized, and carries bunches of ore in places. About 6 ft. a day progress is being made.

MONTANA BINGHAM (Bingham)—Conger vein has been cut in this company's tunnel. Bingham Conger Copper Co. claims that vein apexes on its ground and is working 20 men with view to proving this.

OHIO COPPER (Bingham)—General Exploration Co. is mining and milling 2,000 tons of ore a day. Minimum royalties amount to $6,250 a month, according to the terms of the lease, and have averaged around $15,000. Royalties are 10% on 16c. copper, 14% on 18c. copper, 16% on 19c. copper, etc. Lessees are reported to be making upwards of $20,000 a month.

SELLS (Alta)—Ore shipments are to be started soon from this property adjoining South Hecla, as soon as hauling conditions permit, roads at present being congested with shipments from latter property. Orebins and ore chute from top of dump to bins are completed. Hauling is now done by sleds to Tanner's Flat and from there by wagon to Wasatch over a poor road.

Summit County

PARK CITY ORE PRODUCTION for November amounted to 5,855 tons, estimated at $234,200. This is compared with 8,262 tons shipped in October from four principal producers; five shipping weeks entered into October, while only four were counted in November. The strike, with a 10-day tie-up, at the Coalition, heaviest producer in camp, cut down aggregate one-third from normal output. Producers were: Daly-Judge, 2,010 tons; Silver King Coalition, 1,220; Silver King Consolidated, 1,100; Daly West, 890; Ontario, 75; Daly, 60; others, 300.

DALY-WEST (Park City)—Work is to be resumed at No. 3 shaft and this section of mine is to be unwatered to 1,700-ft. level.

SILVER KING CONSOLIDATED (Park City)—Galena ore has been opened near east end of 1,700 level. Water-tank holding 23,000 gal. has been built on hill slope 186 ft. above collar of shaft for fire protection.

Tooele County

LION HILL CONSOLIDATED (Ophir)—Shipments begun in spring from St. Clair lease are stated to have amounted to $50,000. Siliceous silver ore carrying some lead and gold has been followed for 300 ft.

WISCONSIN

Zinc-Lead District

STONER (Linden)—Stoner Bros. has completed a 50-ton mill at Linden.

VINEGAR HILL ZINC (Platteville)—Company is building 200-ton mill on Blackstone tract at New Diggings.

K. M. & C. (Platteville)—Ray Keating and others are building 75-ton mill on Wilkinson property at Benton, surface equipment of which was destroyed by fire early in summer.

WISCONSIN ZINC (Platteville)—Contemplates building four mills, 200 tons each, on Longhorn, Birkbeck, C. A. Thompson and East End Champion. New Skinner roaster at Champion mine has been put in operation; plant is equipped with six Cleveland-Knowles separators and will handle 800 tons of green ore per week.

CANADA

Yukon Territory

NORTH WEST CORPORATION (Dawson)—Considerable additional stripping work done during current season. Excavating and washing plant installed to treat the gravel of Dominion Creek. A. N. C. Treadgold, managing director. This company is subsidiary of Granville Mining Co. of London and New York.

MEXICO

Pachuca

SANTA GERTRUDIS (Pachuca)—Ore crushed during October, 20,503 tons; estimated profit, £6,740.

SOUTH AMERICA

Chile

BRADEN COPPER (Rancagua)—During September mill treated 89,361 tons of 2.02% ore; produced 7,908 tons of 13.12% concentrates. Minerals Separation treated 87,110 tons; concentrates, 20.77%; copper produced, 1,611 tons.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan District)—Tonnage milled during October was 25,432 and bullion shipments amounted to $135,537. Cable advices are that November cleanup amounted to $144,800. Value of the ore milled was above average.

The Market Report

Metal Markets

NEW YORK—Dec. 8, 1915

All of the principal markets were softer last week, but the recession in prices was trifling in all cases with the exception of spelter, which became rather demoralized.

Copper, Tin, Lead and Zinc

Copper—Business was light, but there were moderate transactions from day to day both with domestic and foreign buyers. The producers generally asked 19¾c., r. t., and some of them reported business at that figure, while others reported that they had been unable to get it. From certain first hands copper was available at 19⅝c., r. t., and a round lot was reported sold at that price on Dec. 3. Sales for delivery in Europe were made at £97 on Dec. 2, and at £98@98½ on the following days. Computations of the New York cash equivalent of these prices were variable owing to the uncertainties of freight rates and exchange. During the last week contracts for carrying copper to Europe were made on the basis of $1 per 100 lb., which a few months ago would have been an incredible figure. Some sales of copper for export were made during the last week on the basis of f.o.b., New York, some of this business being done at 19¼@19½c. Copper prices during the week exhibited a considerable range, there being variations among sellers and also according to deliveries, prices being a little stiffer for near-by deliveries than for the later ones.

Copper Sheets, base price is 25c. per lb. for hot rolled and 26c. for cold rolled, with usual extras. Copper wire is 21@21½c. per lb., carload lots at mill.

Copper Exports from the United States for the week ended Nov. 20 are reported by the Department of Commerce at 19,551,362 lb. The principal items were 7,318,441 lb. to France, 5,977,122 lb. to Italy and 4,009,809 lb. of England. Copper imports for the week were: Metal, 6,348,058 lb.; in ore and matte, 518,133 lb.; total, 6,866,191 lb. The larger imports were from England, Peru, Canada and Chile.

Visible Stocks of Copper in Europe on Nov. 30 were: Great Britain, 13,572; France, 1,473; afloat from Chile, 2,400; afloat from Australia, 3,500; total, 20,945 long tons or 4,691,680 lb. This is a decrease of 623 tons from Nov. 15; and of 3,980 tons from the Oct. 31 report.

Tin—But very little business was done. Owing to the small demand and the larger arrivals the market declined.

Visible Stocks of Tin on Nov. 30 were: United States excluding Pacific ports, 10,062; London, 5,514; Holland, 875; total, 16,451 long tons, or 3,685,024 lb. This is an increase of 3,297 tons during November.

Lead—Early in the week premiums continued to be realized for special brands of lead, but later the market became easier and the metal was available in nearly all quarters at 5.25c., New York, at which price there were more sellers than buyers.

Spelter—On relatively small business the market experienced a severe decline, for which there was apparently no special reason other than the perception of the hollowness of the recent advance. The foreign demand which previously had been the backbone of the market having ceased, temporarily at least, the producers beat a retreat. In the latter part of the week prompt spelter was available from many quarters at 15c., January, at 14c., January-February-March, at 13c. The bulk of the business that was done by producers was for January-March delivery. Spelter for delivery in the second quarter of 1916 was offered at much lower figures, there being appaently a willingness of some sellers to contract at less than 11c. for such business.

Arrivals at Baltimore for the week included 7,471 tons zinc concentrates from Port Pirie, Australia.

Zinc Sheets are in good demand but have not advanced this week, and the base price today is $22 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Exports and Imports of the principal metals, other than iron and steel, in the United States nine months ended Sept. 30, copper and tin in long tons, lead and zinc in short tons:

	Exports		Imports	
	1914	1915	1914	1915
Copper	298,505	221,305	116,941	105,121
Tin	543	515	34,055	39,540
Lead	50,211	92,240	17,556	40,561
Zinc	24,946	95,922	819	715
Ores:				
Zinc	8,499	713	14,931	93,291
Zinc ore, contents	140	609	5,664	36,222

Exports iclude reëxports of foreign material. Copper includes contents of ore and matte; lead, contents of ore and base bullion.

DAILY PRICES OF METALS IN NEW YORK

Dec.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
2	4.7075	55½	19.45 @19.55	38¼	5.25 @5.32½	5.17½ @5.22½	14.50 @17.00
3	4.7038	55	19.40 @19.55	38¼	5.25 @5.32½	5.15 @5.22½	13.50 @16.00
4	4.7038	55	19.35 @19.55	38½	5.25 @5.32½	5.15 @5.22½	13.00 @15.00
6	4.7038	56¼	19.25 @19.50	37¾	5.25	5.15 @5.20	13.00 @15.00
7	4.7125	56⅛	19.45 @19.55	37¼	5.25	5.15 @5.20	12.50 @15.00
8	4.7125	55¾	19.45 @19.55	37¼	5.25	5.15 @5.20	12.50 @15.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Dec.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
2	26 11/16	79½	80	99	20.81	165½	164½	28¾	6 04	100	21.03
3	26 7/16	78¼	78¾	98½	20.71	168	167½	28¼	5 94	93	19.55
4	26 7/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	27 1/16	78	78½	98	20.50	166	165¼	28¼	5.94	89	18.71
7	26 13/16	77¼	77¾	98	20.55	165¾	165	27¾	5 87	87	18.33
8	26¾	76¾	77	98	20.55	166	165½	28¼	5.93	84	17.52

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Exports of Metals and Minerals from Spain eight months ended Aug. 31, as reported by "Revista Minera" in metric tons:

	Metals		Ores, etc.	
	1914	1915	1914	1915
Iron	12,441	95,176	4,881,927	2,991,030
Copper	15,729	11,706	74,975	26,304
Copper precipitate	7,282	8,010	.....	.....
Lead	110.665	95.899	1.560	641
Zinc	1,454	2,843	65,306	21,579
Quicksilver	1,273	703	.....	.....
Manganese	.....	.....	7,238	5,439
Pyrites	.....	.....	2,079,658	1,299,281
Salt	.....	.....	417,075	352,864

Imports of coal for the eight months were 1,446,319 tons, a decrease of 309,734 tons from 1914; imports of coke, 128,027 tons, a decrease of 140,188 tons.

Other Metals

Aluminum—The market remains about the same. Imported metal is scarcer, and the American producer has none to spare for early delivery except on contract. Quotations are 57@60c. per lb. for No. 1 ingots, New York, for a spot delivery.

Antimony—The market continues strong, although business has been on a moderate scale. Supplies are low and prices are very firm. Chinese and other ordinary brands are quoted at 39@40c. per lb. Cookson's is held as high as 55c., with very little to be had. Under present conditions it costs close to 40c., duty paid, to import Chinese. Antimony ore is also in small supply and has been sold at $2.55 per unit.

Nickel—There is no change to be reported. Ordinary forms are 45@50c. per lb., according to size and terms of order. Electrolytic is 3c. per lb. higher.

Quicksilver—This metal has advanced sharply and is very firmly held. Stocks are very low. The New York quotations are $120@125 per flask of 75 lb. Some dealers will not quote, having no stocks or only enough to supply regular customers. San Francisco reports by telegraph a firm market, very light stocks and sales as high as $115 per flask, with little or no prospect of a decline. On the other hand, London price is unchanged at £16 10s. per flask, with the same quotation from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted as 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium metal,** 75c. per lb., New York.—**Cobalt metal,** 97% pure, is sold at $1.75@2 per lb.—**Magnesium,** pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.

Gold, Silver and Platinum

NEW YORK—Dec. 8

Gold in the United States Dec. 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,427,167,399; in Treasury current balances, $221,663,793; in banks and circulation, $611,856,355; total, $2,260,687,547. This is an increase of $62,573,785 in November.

Gold sales from the United States Assay Office in New York in November were $3,679,450, being $226,686 more than in October, and $570,607 more than in November, 1914. For the 11 months ended Nov. 30, the total sales were $58,860,366 in 1914, and $31,572,157 in 1915; a decrease of $27,288,209 this year.

Platinum—There is no change in the market. Supplies are very scarce and dealers hesitate to make quotations, transactions being rather a question of negotiations. Quotations are approximately $70@74 per oz. for refined platinum and $74@78 per oz. for hard metal.

Iridium—This metal is also very scarce. No definite quotations can be given, sales being a matter of negotiation in each case.

Palladium—Some sales are reported at $45@50 per oz., according to size and terms of order.

Coined Silver in the United States Dec. 1 is estimated by the Treasury Department as follows: Standard dollars, $568,271,655; subsidiary coins, $188,695,357; total, $756,967,012. Of the standard dollars $489,093,355 are held in the Treasury against silver certificates outstanding.

Silver has had some reaction owing to the filling of the India orders in connection with Mint buying. The disposition of the English Mint is not to force the price up but to absorb the floating amounts of bullion at current rates.

Exports of silver from London to the East Jan. 1 to Nov. 24, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£4,679,500	£3,495,000	D. £1,184,500
China	42,000	7,000	D. 35,000
Total	£4,721,500	£3,502,000	D. £1,219,500

Stocks in Bombay are reported on Nov. 24 as reduced to 5,700 bars.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Dec. 4

The base price paid this week for 60% zinc ore was $100 down to $94 at week end. The base price paid for 80% lead ore was $70 per ton.

SHIPMENTS WEEK ENDED DEC. 4

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,104,000	125,500	791,400
Year	195,231,750	5,643,500	27,325,710

Shipped during week to separating plants, 5,588,000 lb. zinc ore.

JOPLIN, MO.—Dec. 4

Blende, high price, $107.35; base per ton 60% zinc, premium ore, $105; medium, $100@90; lower grades down to $85; calamine base per ton 40% zinc, $70@60; average selling price, all grades of zinc, $97.93 per ton. Lead, high price $72.90, base per ton 80% metal content, $70@71; average selling price, all grades of lead, $66.64 per ton.

SHIPMENTS WEEK ENDED DEC. 4

	Blende	Calamine	Lead	Values
Totals this week	11,825,620	1,063,950	2,236,520	$705,690
Totals this year	546,877,620	42,773,650	85,146,700	25,202,770

Blende value, the week, $594,890; 49 weeks, $21,822,500.

Calamine value, the week, $36,280; 49 weeks, $1,098,150.

Lead value, the week, $74,520; 49 weeks, $2,282,120.

While this week's shipment is above an average one it is a drop of 2,700 tons from last week and shows the effect of the lower spelter market. During November the demand was exceptionally strong and practically all the reserve stock was shipped away, leaving only 1,700 tons at Granby where there was 4,000 tons a month ago. Miami is about cleaned up and none of the other camps have had more reserve than a two days' production at the end of the week for many months. Miners working on a sliding scale wage base will be paid during December on an average base price of zinc for November of $101.25, against $82 base of November wage scale. They were notified of this last Monday and nothing more was heard of the threatened strike.

Iron Trade Review

NEW YORK—Dec. 8

The iron and steel trades continue strong and active. The most notable change apparent is an increase in domestic orders and some falling off in steel for shells and other war munitions for export. The gain in domestic orders is largely in structural steel.

The control of the Cambria and the Pennsylvania steel companies seems to be still in doubt. Numerous rumors as to the condition of affairs and the projected combinations are current, but there is no certain information to be had.

The syndicate which is planning a combination of Eastern blast furnaces now has options on the Thomas, the Wharton, the Empire and the Crane iron companies. These companies together own 15 blast furnaces in Pennsylvania and New Jersey with iron-ore mines, coal mines and coke ovens. All are producing properties and would constitute an important block of merchant furnaces.

Exports from Baltimore for the week included 2,751,992 lb. steel bars, wire rods and skelp to Liverpool.

The Bethlehem Steel Co. is having plans prepared for the erection of three new blast furnaces at South Bethlehem. The Midvale Steel and Ordnance Co. is arranging to build an additional blast furnace at Coatesville, Penn., at the Worth Brothers plant.

PITTSBURGH—Dec. 7

The runaway market in steel products that was so apparent last month is be'ng checked to an extent by the fact that there is little to run away. The steel mills are filled up solidly with business for months to come, while buyers with scarcely an exception have gotten their tonnages onto the mill books, the real question in the trade being one of arranging deliveries so as to discommode the smallest number of buyers, of course paying attention to the sequence in which specifications have been received. This sequence is not the governing element in all instances by any means as cases are cited of buyers desiring some of their later specifications to be filled before earlier specifications.

Finished-steel prices have become practically nominal in the majority of lines. While precise quotations are available as representing the market in general it is frequently impossible to buy at them. Thus bars, plates and shapes are 1.70c., with premiums for early delivery, and open contracts usually refused at any price. Sheets are strong at 2.50c. for black, while 2.25c. on blue annealed has become practically nominal. The leading interest quotes nominally 4.75c. on galvanized, but is practically filled up for three months. Wire mills are congested with business.

A situation has been reached in which the purely domestic demand for steel is beyond any previous record and the war demand, while important, is no longer the principal element in the market. Recent rumors that the Allies will buy less when present contracts for war steel expire do not seem to cause the least concern in the steel industry.

Pig Iron—The boom in steel has reached pig iron, as prices are advancing sharply with a comparatively small turnover, all indications being that the trade is facing an actual scarcity. The supply of idle furnaces to come in and retard the advance seems now to be exhausted. Sales of bessemer pig iron reported in the local market include 3,500 tons at $18, an advance from $17.50, 1,100 tons at $18.50 and 1,000 tons, in two lots of 500 tons each, made this week at $19, apparently the minimum of the market today and representing an advance of $1.50 on a turnover of scarcely more than 5,000 tons, altogether an unprecedented performance for bessemer iron. It is stated that a firm bid of $20 for January delivery has been turned down. Foundry iron is in fairly large request and prices have been advancing sharply, by 50c. to $1 in the week. Basic shows no activity and the last important domestic sales, at $16, Valley, have no bearing on the present situation. There have been sales for export at around $18, Valley, but under peculiar conditions. We quote: Bessemer, $19@20; basic, $17@18; foundry and malleable, $17.50@18; gray forge, $17@17.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report average prices in November, computed from actual sales in 1,000-ton lots and over, at $16.615 for bessemer, an increase of 61.5c., and $15.518 for basic, an increase of 50.33 cents.

Ferromanganese—Better deliveries of English ferromanganese are in sight and the $100 contract price is a definite factor, domestic producers being therefore disposed to recede from their former quotation of $110. Prompt lots bring about $100 per ton.

Steel—Hardly anything is being done in the open market, steel being so scarce. A producer of openhearth steel has bought a round lot of bessemer billets at $29 for use in its finishing mills, giving it more openhearth steel to sell in unfinished form. Several similar transactions, by other mills, were reported last month. The market is quotable at $29 for bessemer billets and sheet bars and $30 for openhearth, at maker's mill, Pittsburgh or Youngstown, but the quotations are practically nominal. Forging billets are $48@50 and rods $38@40, Pitsburgh.

Foreign Trade in Iron and Steel in the United States 10 months ended Oct. 31 is valued by the Department of Commerce as below, the figures including machinery:

	1914	1915	Changes
Exports	$152,776,839	$251,112,482	I. $98,335,643
Imports	22,905,321	14,818,206	D. 8,087,115
Excess, exports	$129,871,518	$236,294,276	I. $106,422,758

The chief changes were in the later months. September exports were more than three times those of last year.

FERROALLOYS

Ferrosilicon, high grade, 50%, is $83@85 per ton at furnace, according to size of order; bessemer ferrosilicon, from $34 at furnace for 16%, down to $24 for 10%, for 1916 delivery. Spot is $1 higher.—**Ferrotitanium** is 8@12.5c. per lb., according to size of order.—**Ferrovanadium** $2.25@2.50 per lb. of contained vanadium.—**Spiegeleisen,** $28@30 per ton at furnace.—**Ferrotungsten** is very high and irregular. Sales have been reported as high as $6 per lb. of contained tungsten; while **Tungsten** metal has sold at $7 per lb. for 98% pure metal.

IRON ORE (By Telegraph)

Pittsburgh, Dec. 8—Lake Superior iron-ore prices for next season are announced today as follows: Old Range bessemer, $4.45; Mesabi bessemer, $4.20; Old Range nonbessemer, $3.70; Mesabi nonbessemer, $3.55; all f.o.b. Lake Erie ports. The advance over last season's schedule is approximately 75c., except that Old Range bessemer advances only 70c. Some of the producers favored an increase of $1. The new prices are 50c. below the schedules obtaining in 1907 and 1910, which were the highest since the 1900 season.

OTHER ORES

Tungsten Ore—The Primos Mining and Milling Co., one of the large purchasers of tungsten ores, has recently published a revised schedule of purchase prices for Colorado ores. Under prevailing market conditions, miners are doing remarkably well mining ore of as low grade as 2% which sells for $29 per ton or at the rate of $14.50 per unit, a figure double that paid 18 months ago for 60% material which is now worth $35 per unit or $2,100 per ton. Intermediate figures in value per ton are as follows: 3%, $46; 4%, $92; 5%, $115; 10%, $230; 15%, $345; 20%, $460 per ton.

COKE

Connellsville—The market for furnace coke is quiet, but there is an undertone of strength, there being few sellers at quoted prices of $2.15@2.25 for prompt furnace, and a definite scarcity may develop over the holidays, as is usually the case. There is no demand for contract furnace coke, quotable nominally at $2.35@2.50 for first half and $2.25@2.35 for the whole year. Foundry coke is firm and moderately active at $3@3.25 for prompt or contract, per net ton at ovens. The sharp advances occurring in pig iron are not necessarily favorable to the coke market, as they indicate a scarcity of pig iron due to there being few if any idle furnaces to be blown in, so that no increased consumption of coke is suggested by the pig-iron advance.

Coal and Coke Shipments, Pennsylvania R.R. lines east of Pittsburgh and Erie, 10 months ended Oct. 31, in short tons:

	1914	1915	Changes
Anthracite	9,067,445	8,687,790	D. 379,655
Bituminous	37,840,834	35,983,366	D. 1,857,468
Coke	8,277,868	9,604,424	I. 1,326,556
Totals	55,186,147	54,275,580	D. 910,567

October total tonnage was 6,615,053 tons, an increase of 875,511 tons over last year.

British Fuel Exports, 10 months ended Oct. 31, in long tons:

	1914	1915	Changes
Coal	52,060,846	36,944,758	D. 15,116,088
Coke	975,254	798,188	D. 177,066
Briquettes	1,487,943	1,087,660	D. 400,283
Steamer coal	16,037,409	11,745,472	D. 4,291,937
Total	70,561,452	50,576,078	D. 19,985,374

The steamer coal is fuel furnished to steamships in foreign trade. Imports are very small.

Chemicals

NEW YORK—Dec. 8

The general market seems to have a stronger undertone and business looks better for next year.

Arsenic—The market is still rather quiet with small sales. Quotations are $3.75@4 per 100 lb.; but it is claimed that they can be shaded for a good order.

Copper Sulphate—Business has been chiefly in small lots. Prices have advanced sharply, the current quotations being $10 per 100 lb. for carload lots and $10.25 per 100 lb. for smaller orders.

Nitrate of Soda—The position is very strong, notwithstanding the increased production in Chile. This has been offset by the difficulty in getting ships, and the high ocean freights. The quotations are firmer, spot being especially strong. As high as $3.25 per 100 lb. is asked for spot, while $3 per 100 lb. is named for futures.

Shipments from Chile for the 10 months ended Oct. 31 are reported as below, in tons:

	1914	1915	Changes
United States	454,950	713,700	I. 258,750
Europe	1,072,400	775,300	D. 297,100
Totals	1,527,350	1,489,000	D. 38,350

Pyrites—Arrivals at Baltimore for the week included 2,514 tons of pyrites from Spain.

Imports and Exports of Chemicals in the United States nine months ended Sept. 30, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	3,171,867	2,655,334	700	8,825
Bleach	29,185,862	6,779,926	12,654	120,126
Acetate of lime	.....	.....	41,514,968	17,586,573
Calcium carbide	.....	.....	26,401,723	28,809,380
Potash salts	25,065,751	13,960,537	481,655	983,178
Sodium cyanide	1,240,904	3,662,888	.....	1,796,927
Soda salts, value	$468,664	$361,313	$10,061	$22,635

Exports include reëxports of foreign material. This statement does not include nitrate of soda nor crude potash salts used chiefly as fertilizers.

Assessments

Company	Delinqe	Sale	Amt.
Blue Bull Reorg., Nev	Nov. 1	Dec. 6	0.01
Clear Grit, Ida	Dec. 14	Jan. 5	0.0015
Coeur d'Alene Inv., Ida	Oct. 25	Dec. 6	0.002
Columbus Ext., Utah	Dec. 11	Jan. 3	0.02
Confidence, Nev	Dec. 24	Jan. 14	0.10
Cons. Imperial, Nev	Nov. 30	Dec. 21	0.01
Darby M. & M., Ida	Nov. 16	Dec. 16	0.00125
Dry Canon Cons., Utah	Dec. 18	Jan. 17	0.001
Emerald Oil, Utah	Nov. 27	Dec. 16	0.06
Eureka M. & M., Ida	Nov. 26	Dec. 27	0.001
Great Western, Nev	Nov. 15	Dec. 7	0.001
Hancock Cons., Mich	Jan. 3	.....	1.00
Hector, Ida	Nov. 18	Dec. 10	0.005
Idaho & Los Angeles, Ida	Nov. 26	Dec. 27	0.005
Ivanhoe, Ida	Nov. 8	Dec. 9	0.0025
Jack Waite, Ida	Nov. 20	Dec. 20	0.01
Laclede, Ida	Dec. 6	Dec. 27	0.003
Leonora M. & M., Utah	Nov. 27	Dec. 17	0.005
Lucky Swede, Ida	Nov. 11	Dec. 11	0.002
Military M. & M., Ida. (post.)	.....	Dec. 11	0.0065
Missoula Copper, Ida	Nov. 15	Dec. 15	0.002
Montana Standard	Nov. 15	Dec. 15	0.005
National Copper, Ida	Nov. 20	Dec. 18	0.01
National Lead, Ida	Nov. 15	Dec. 15	0.001
Nevada-Douglas, Nev	Nov. 30	Dec. 31	0.10
New Arcadian, Mich	Dec. 1	.....	0.50
New Baltic, Mich	Jan. 15	.....	0.50
O. K. Ex. M. & R., Utah	Nov. 20	Dec. 15	0.005
Oreano, Ida	Dec. 18	Jan. 18	0.001
Oriental, Nev	Nov. 6	Dec. 7	0.003
Original, Nev	Nov. 6	Dec. 7	0.003
Phedora, Ida., (post.)	.....	Dec. 11	0.0005
Phoenix, Mich	Jan. 1	.....	1.00
Rescue Eula, Nev	Dec. 6	Jan. 10	0.01
Seg. Belcher & Midas, Nev	Dec. 12	Jan. 6	0.02
Silver Cliff, Ida	Nov. 8	Dec. 6	0.0025
Sonora M. & M., Ida	Nov. 4	Dec. 17	0.003
Sunset Dev., Ida	Dec. 8	Jan. 3	0.002
Sunshine, Ida. (post.)	.....	Dec. 15	0.0006
Ton. Gipsy Queen, Nev	Oct. 29	Dec. 6	0.01
Tonopah Midway, Nev	Dec. 11	Jan. 11	0.01
Umatilla Ton., Nev	Nov. 8	Dec. 13	0.005
West Toledo, Utah	Dec. 16	Jan. 3	0.01
Wolf Mountain, Utah	Nov. 12	Dec. 14	0.0025

Stock Quotations

Among sales at auction we note: 3,061 Great Sierra Consol. Silver Co., $3 lot; 112 Magistral Exploration Co., $8 lot; 600 Parrott City Gold Placer Mining and Water Power Co., $6 lot; 1,300 Navaho Gold Mining Co., $10 lot; 7,200 Goldfield Tomboy Mining Co., $11 lot; 250 British Guiana Consol. Co., Ltd., $15 lot; 170 Ohio Zinc Co., $11 lot; $11,300 Woodstock Iron and Steel bond certifs. of deposit, $100 lot.

COLO. SPRINGS Dec. 7		SALT LAKE Dec. 7	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02½	Beck Tunnel	.07½
Cripple Cr'k Con.	.0095	Black Jack	‡.07
C. K. & N.	‡.02	Colorado Mining	.09
Doctor Jack Pot	.09¼	Crown Point	.01½
Elkton Con	.31¾	Daly-Judge	7.75
El Paso	.78	Emma Cop	.19½
Findlay	.03½	Gold Chain	.54
Gold Dollar	‡.02	Grand Central	‡.50
Gold Sovereign	.06¼	Iron Blossom	.96
Golden Cycle	2.03	Lower Mammoth	.06
Isabella	.19	May Day	.18
Jack Pot	‡.06¼	Opohongo	‡.00½
Jerry Johnson	.05	Prince Con	.76
Lexington	‡.005	Seven Troughs	.01½
Mary McKinney	.43	Silver King Coal'n	3.37½
Pharmacist	.006	Silver King Con	2.30
Portland	1.82	Sioux Con	.03½
Raven B. H.	‡.03	Uncle Sam	.08
Vindicator	‡1.74¼	Yankee	.38½

TORONTO Dec. 7			
Bailey	.04¼	Dome Exten	.33
Chambers Feriand	.25	Foley O'Brien	.50
Contagas	4.60	Hollinger	29.15
La Rose	.70	Imperial	.05
Peterson Lake	.36½	Jupiter	.19
Right of Way	‡.05½	McIntyre	1.03
Seneca Superior	.60	Pearl Lake	‡.00½
T. & Hudson Bay	23.00	Porcu. Crown	.90
Timiskaming	.68	Preston E. D.	.05½
Trethewey	‡.18	Vipond	.77
Wettlaufer-Lor	.08½	West Dome	.17½

SAN FRANCISCO Dec. 1			
Alta	.08	Belmont	4.43¾
Andes	.10	Jim Butler	1.09¾
Best & Belcher	.05	Lone Star	.03
Caledonia	.44	MacNamara	.03
Challenge Con	.06	Midway	.15
Chollar	‡.02	Mont.-Tonopah	.34
Confidence	.15	North Star	.17
Con. Virginia	.23	Rescue Eula	.08
Gould & Curry	.04	West End Con	.83
Hale & Norcross	.04	Atlanta	.25
Jacket-Cr. Pt	.15	Blue Bell	.03
Julia	‡.02	Booth	.40
Mexican	.33	C.O.D. Con	.03
Occidental	.75	Comb. Frac	.07
Ophir	.29	D'field Daisy	.04
Overman	.08	Jumbo Extension	1.21¼
Potosi	‡.02	Pitts.-Silver Peak	.06
Savage	.06	Round Mountain	.41
Sierra Nevada	.49	Sandstorm Kendall	.08
Union Con	.63	Silver Pick	.05
Utah Con	‡.03	Central Eureka	.06

N. Y. EXCH. Dec. 7	
Name of Comp.	Clg.
Alaska Juneau	10⅜
Am.Sm.&Ref.,com	99
Am. Sm. & Ref., pf.	110½
Am. Sm. Sec., pf. A	90
Am. Sm. Sec., pf. B	85⅛
Anaconda	87⅛
Batopilas Min	2⅜
Bethlehem Steel	468½
Bethlehem Steel, pf.	155
Chile Cop	25½
Chino	54½
Colo. Fuel & Iron	51⅞
Crucible Steel	74
Dome Mines	29⅜
Federal M. & S., pf.	48
Great Nor., ore., ctf.	49⅜
Greene Cananea	44½
Guggen. Exp.	78
Homestake	122⅜
Inspiration Con	45
International Nickel	193⅜
Miami Copper	34½
Nat'l Lead, com	65½
National Lead, pf.	110½
Nev. Consol	16⅜
Ontario Min	7⅛
Quicksilver	3⅛
Ray Con	25⅛
Republic I&S, com	53⅛
Republic I&S, pf.	110
Tennessee Copper	58
Utah Copper	80
U. S. Steel, com	86⅛
U. S. Steel, pf.	116

N. Y. CURB Dec. 7	
Alta Con	.10
Beaver Con	.48
Big Four	.05
Braden Copper	16
Buffalo Mines	1.10
Can. Cop. Corpn.	2⅛
Cashboy	.07
Cerro de Pasco	37
Con. Ariz. Sm.	1⅛
Con. Coppermines	1⅛
Con. Nev.-Utah	1/16
Dia. Black B.	.04
Florence	.37
Goldfield Con.	1 3/16
Goldfield Merger	.17
Howe Sound	4⅛
Kennecott Cop.	53
Kerr Lake	4⅛
Magma	15
McKinley-Dar-Sa	.73
Mines of Am	3 7/16
Mother Lode	.32½
Nevada Hills	‡.20
New Utah Bingham	3⅛
Nipissing Mines	7⅛
Oro	.06
Ray Hercules	3⅛
St. Joseph Lead	14
South Utah	.25
Stand'd Oil of N.J.	507
Standard S. L.	2⅞
Stewart	⅛
Success	.61
Tonopah	7⅛
Tonopah Ex	4 1/16
Tonopah Merger	.55
Tribullion	⅛
Yukon Gold	3

LONDON Nov. 22	
Alaska Tre'dwell	£6 17s 6d
Burma Corp	1 11 3
Cam & Motor	0 13 9
Camp Bird	0 7 9
El Oro	0 10 0
Esperanza	0 11 0
Mexico Mines	4 6 3
Nechi, pfd.	0 12 3
Oroville	0 14 0
Santa Gert'dis	0 10 6
Tomboy	1 4 0
Tough Oakes	0 11 3

BOSTON EXCH Dec. 7	
Name of Comp.	Clg.
Adventure	1½
Ahmeek	394
Alaska Gold M	23⅛
Algomah	1½
Allouez	56
Am. Zinc	68⅛
Ariz. Com., ctfs.	7⅛
Bonanza	.35
Butte-Balaklava	3 3/16
Butte & Superior	71½
Calumet & Ariz.	69
Calumet & Hecla	548
Centennial	16
Copper Range	57
Daly West	3
East Butte	15⅜
Franklin	9¼
Granby	80
Hancock	16
Hedley	28½
Helvetia	.25
Indiana	5
Island Cr'k, com	48½
Island Cr'k, pfd	89½
Isle Royale	27½
Keweenaw	2⅛
Lake	15½
La Salle	5½
Mason Valley	1½
Mass	12½
Mayflower	3½
Michigan	2
Mohawk	86½
New Arcadian	9⅛
North Butte	31½
North Lake	1⅛
Ojibway	1½
Old Colony	2⅛
Old Dominion	58
Osceola	84½
Quincy	85
Santa Fe	3½
Shannon	8
Shattuck-Ariz	35
Superior	25½
Superior & Bost	2⅛
Tamarack	48
Trinity	9⅛
Tuolumne	.30
U. S. Smelting	46⅛
U. S. Smelt'g, pf.	48⅛
Utah Apex	3½
Utah Con	11½
Victoria	2½
Winona	3⅛
Wolverine	58
Wyandot	1⅛

BOSTON CURB Dec. 7	
Bingham Mines	8
Boston Ely	.38
Butte & Lon'n Dev.	.35
Calaveras	2
Calumet-Corbin	.15
Chief Con	1 1/16
Cortez	.40
Crown Reserve	.63
Davis-Daly	1⅛
Eagle & Blue Bell	1 1/16
First Nat. Cop	5⅛
Houghton Copper	2½
Iron Cap Cop., pf.	7
Majestic	1½
Mexican Metals	.36
Nevada-Douglas	.80
New Baltic	3½
New Cornelia	9⅛
Ohio Copper	.24
Oneco	1
Raven Copper	.10
Rex Cons	.25
Smokey Dev	.15
So. Lake	5⅛
Tonopah Victor	.35
United Verde Ext.	4 1/16
Utah Metal	10⅛

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	49.385	28.083	23.199	23.925
November	58.995	49.082	51.714	27.263	22.703	25.094
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739	18.627	53.227	77.744	*	93.273
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	39.224	139.391	167.670
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.499	‡	23.994
November	3.683	5.155	3.585	5.078	18.500	26.278
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	15.962	4.962	15.792	25.016	88.409
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	18.26	13.43	17.30	13.83	17.20
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....